



SATURDAY, APRIL 22, 1871.

IMPROVED CYLINDER COCK.

Our engraving represents a new form of cylinder cock designed by Mr. Buchanan, of the Hudson River Railroad. The difficulty of keeping the ordinary plug cock from leaking first drew his attention to the necessity of some different arrangement. It will be seen that the plan which he adopted is simply a conical seat valve, *B B*, which is opened by the "inclined plane" in the flat rod, *C C*, which is operated by the ordinary appliances used for opening cylinder cocks. The "case" consists of two pieces, one, *D*, which screws into the cylinder, the other, *E*, which is screwed into *D*. By this means the valve can be taken out and ground into its seat by simply unscrewing the lower piece, *E*.

When the valve is lifted from its seat the water or steam escapes through the segmental openings and out through the hole, *A*. It will also be observed that in case the piston should create a vacuum in the cylinder, the valve will lift and admit air into it. Although the only object which led to the adoption of these valves or cocks was to obviate the trouble which was expended in keeping tight those ordinarily used, yet it was found by experience, that the piston packing of those engines which were supplied with these valves stood much better than it did on the engines with the old plug cocks. This result is an important one and worthy of careful attention. It might be attributed to two causes: first, to the exclusion of cinders from the cylinders by supplying air through the cocks instead of through the exhaust; and, second, to the fact that with these valves no vacuum could be found, or at least sustained for any length of time in the cylinders.

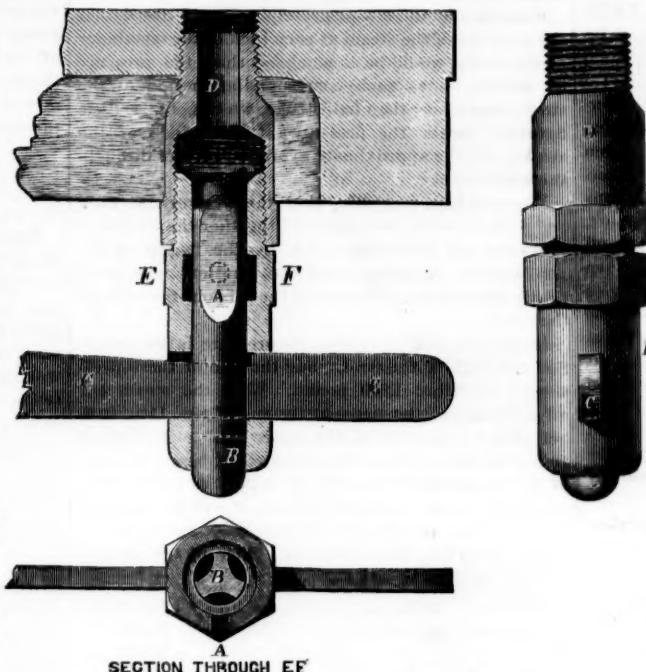
Probably to most of our readers the reason for this result will not appear so important as the result itself. The latter can be tested experimentally at a comparatively small expense, and even though no good effect upon the packing should be observed, yet the plan furnishes a valve which is easily kept in repair, and in that way is an improvement on the old form of cylinder cocks.

MILLER'S FISH JOINT AND LOCK NUT.

This joint is made with fish plates of the ordinary form except that one of them has on its outer face a convex rib, three-fourths of an inch broad and standing, at the center, one-twentieth of an inch from the plane of the face of the bar. The bar is secured by four $\frac{3}{4}$ -inch bolts with heads $1\frac{1}{4}$ inches in diameter, resting on vulcanite gum springs of the same diameter and $\frac{1}{4}$ inch thick, fitted in recessed washers. Each nut has, in its inner face, two concave grooves crossing at right angles, corresponding to and fitting on the convex rib, and, when screwed down firmly, makes a lock, being kept in place by the compression of the gum springs. These springs being confined in the recessed washers, can be subjected to great pressure. Their elasticity compensates for and absorbs any jarring motion, and allows for contraction or expansion of the metals. As the nuts are drawn tightly to the rib of the fish bar, by the springs, they will not work loose and rattle.

One of the important advantages claimed by the inventor is that the joint, owing to its simplicity, can be applied by track men who are not skilled workmen. In substituting this joint for others, all the fish bars of the common form need not be taken off, as they may be used on one side of the rail and form a part of the new joint. These joints are furnished with $\frac{3}{4}$ inch iron bolts or with $\frac{1}{2}$ inch patent steel bolts, which latter are better for steel rails, as they admit of

smaller holes being drilled in the web of the rail. It will be seen from an examination of the engravings that this joint may be made at little additional expense, as the extra fastening nut usually used is not needed in this case and the cost of the springs and different form of bar and nut is very small. The inventor offers to railroad companies to "lay down a sufficient quantity on such portion of roads as is most used, " where it may be subjected to the severest test, "allowing sufficient time therefor, and if it does not prove as represented I will remove the joints



IMPROVED CYLINDER COCK.

The St. Louis Bridge.

The Illinois and St. Louis Bridge—the greatest work of the kind in the world—the most gigantic undertaking of engineering in modern times—is placed beyond the possibility of failure, and stands, to-day, a recorded triumph. Yesterday afternoon the east abutment pier—that at the Illinois shore—rested on its world-enduring foundation—solid rock.

As it was pretty well known that the pier would reach the rock sometime yesterday afternoon, all who could procure passes to witness the final lowering of the tower of hewn stone. The pier and the surrounding boats, platform and available grounds, were crowded with workmen and eager, speculative spectators, when at 4:15 o'clock, Superintendent McComas gave the word, the valves of the air-chamber were opened, and the compressed air rushed with deafening noise from the pipes. In five minutes the pier sunk suddenly about an inch, and in the course of ten minutes more, falling about the same distance each time, touched the solid rock 109 feet and 8 inches below the surface of the water, the spectators gazed in wrapt wonder and astonishment the while, awe struck in contemplating the vastness and grandeur of the triumph. A cannon had been placed on each of the four piers, and, when the announcement that the rock had been reached was made, the guns boomed, flags were unfurled, the steam whistles blew, and the air was filled with deafening cheers. Each gun fired nine rounds, and the whistles blew for half an hour, at the end of which time amazement had given place to a sense of relief and quiet satisfaction, which manifested itself in hand-shaking and the exchange of congratulations.—*St. Louis Times*, March 29.

A New Feed-Water Heater.

The Springfield *Republican* thus describes a feed-water heater fitted to an old locomotive on the

Connecticut River Railroad, and which is said to have increased the efficiency

of the engine in a very considerable degree, and to have secured an appreciable economy of fuel: "The water is pumped from the tank in the tender through a copper pipe, $1\frac{1}{2}$ inches in diameter, to the 'heater,' which is a coil of pipe of the same size around

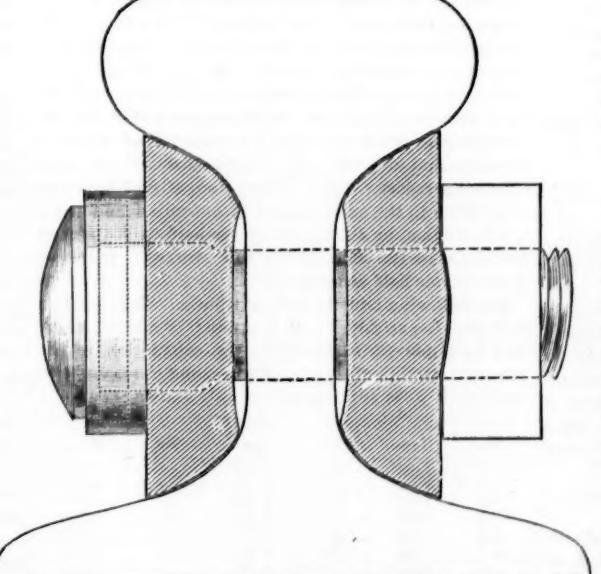
the 'cone-pipe' in the smoke-stack, and from this coil the water, heated to more than 200° Fahr. during its passage through the coil, passes in a copper pipe on the outside of the boiler opposite its passage when cold, and into the boiler. The heat used in raising the water to this temperature is waste heat, escaping through the cone-pipe. A portion of the 'exhausted' steam passes through an extra 'exhaust-pipe' to the 'heater,' and helps in the heating process."

Commodore Vanderbilt's Car.

A coach known as the "Director's Car," built especially for Commodore Vanderbilt, is very nearly completed. It is a few feet shorter than an ordinary coach, and will be one of the most cosy cars ever built. The body of the car outside is of a cream color, with cornices of a darker shade, and presents a decidedly handsome appearance. On either side is a keystone with the Commodore's monogram. One light of the best French plate glass constitutes a window, the centre plates being 42x36 inches, and those at the ends of the sides of the car, 28x36. There is nothing gaudy or showy about the coach. The inside wood-work is of black walnut, and finished as finely as the cover of a first-class piano. The decorations are elegant. The mountings, door knobs, hat-racks, lamp finishings, etc., are

all heavy silver-plated. The car is divided into three compartments: First, the main room, twenty-five by nine feet; a private parlor about eight feet square, and a sleeping apartment. At one end of the car are two closets, one of which is furnished with refrigerator, etc. The water-closet and wash-room have the latest improvements. The car will be lighted with six elegant lamps, in which sperm candles are to be used, the Com-

MILLER'S PATENT FISH JOINT AND LOCK NUT.



that a severe trial will afford evidence of stability and economy in its use.

The inventor is Mr. J. Miller, Jr., at the office of the Central Railroad of Iowa, Marshalltown, Iowa.

THERE were 75 proposals received for the construction of 108 miles of the Chesapeake & Ohio Railroad west of White Sulphur Springs.

modore preferring this kind of light to gas. The upholstery work has not been done yet. The platform is provided with neat but strong iron railings, with drop gates at either side, so that when so desired the platform is surrounded with a fence of iron work about two feet and a half high. It was Commodore Vanderbilt's orders that the coach should not be shown, and his wishes have been regarded.—*Albany Times*.

Contributions.

SIMPLE RULES FOR LOCOMOTIVE ENGINEERS AND MACHINISTS.

[Continued from Page 26.]

THE COMPARISON OF DIFFERENT ENGINES.

A common mode of comparison of engines of different dimensions, is that of the quantity of steam expended in going a given distance. Where the steam expended is adopted as a standard whereby to determine the proper heating surface, or other proportions of an engine, no account is made of time or pressure. Although one engine may be proportioned to work off double the volume of steam of another, in going a given distance, it may by the same proportions require twice the time to do so. The capacity of a boiler to raise steam, however, is not to be measured by the amount of steam which can be raised in a given distance, but in a given time. A boiler of the size of a common cooking stove would furnish steam enough to go a thousand miles, but it would take a great amount of time in doing so. Yet the mode of comparing by the quantity of steam expended should be understood by engineers and machinists.

In every engine of ordinary construction, four cylinders full of steam are used at every revolution of the driving wheels. If the drivers do not slip they will make as many turns in going one mile as their own circumference is contained in the distance of a mile. The circumference of any wheel is 3.1416 times its diameter. A mile is 5,280 feet, or 63,360 inches.

In all calculations of this kind, all dimensions had best be reduced to inches and decimals of an inch. A 5-foot driver is 60 inches in diameter, and this multiplied by 3.1416 gives 188.49 inches as the circumference, or, say, 188.5 inches.

A 7-foot driver is 84 inches in diameter, or 263.89 inches in circumference. The number of inches in one mile, 63,360, may be divided by the circumference, thus found, of any sized wheel, and the quotient will express the number of turns which such a wheel will make in running one mile, making no allowance for slipping.

The cubic contents of four cylinders full of steam, multiplied by the number of turns of the drivers per mile, will then express the entire bulk or volume of steam used in going one mile.

The cubic quantity of steam expended at one stroke of one piston is the product of the area of the piston multiplied by the length of stroke. The capacity or content of the steam port, and spare space in the cylinder end (technically speaking, "clearance") ought also to be added, although this is sometimes disregarded.

The area of the piston is found by multiplying its diameter into itself, and the product by .7854, pointing off four places for decimals. The last product, in square inches, is to be multiplied by the length of the stroke, in inches, for the cubic inches of steam expended at one stroke. The quantity used at one revolution will be four times as much, and that quantity may be then divided by 1,728, to bring it to cubic feet.

It now only remains to multiply the cubic feet of steam used at each revolution by the number of revolutions per mile, and the product will represent the bulk or volume of steam per mile. We are not as well prepared to explain what use can be made of this quantity when found, but the ability to find it is certainly not to be considered as unworthy. It is a quantity which is sought, and of which some use is made by many engineers. But it does not regard the pressure or density of the steam used, nor the time in which it is expended. We may say that the cylinders are filled by expansion, at every stroke, although the steam may be cut off at half stroke.

TO ESTIMATE THE ADVANTAGE GAINED BY EXPANSION OF STEAM, OR OF THE CUT-OFF.

The principle by which the gain by the cut-off depends is one of the easiest to comprehend, although we have reason to believe that a large number of engineers have never taken pains to examine it. Suppose we state this principle, and apply its demonstration to the operation of the cut-off. The principle is this: The pressure of steam is inversely as its bulk, or the space occupied. That is, its pressure is greater as the space which it is made to occupy is less, and its pressure is also less as its bulk is greater; and the degree in which the pressure of the steam is in-

creased corresponds exactly with the reduction in its bulk.

If steam of 120 pounds pressure per square inch were admitted upon a piston throughout an entire stroke of 20 inches, there would be, of course, an expenditure of one entire cylinder full of steam, with a constant pressure of 120 pounds. But if, at 10 inches of the length of (or at one-half) the stroke, the admission of steam should be shut off, either by a lap valve, or a separate cut-off valve, the remainder of the stroke of the piston would be performed only by the expansion of the steam already in the cylinder.

Knowing, by the law or principle already stated, that the pressure of the steam at each inch of the remainder of the stroke would be as much *less* than the pressure at half-stroke as each corresponding period of the stroke was *greater* than half-stroke, we can, by a little figuring, obtain the pressure at each inch of the stroke, and the approximate average pressure throughout the whole stroke.

We must first, therefore, find the pressure at each end of the stroke; and next add together the different pressures and divide their sum by the length of the whole stroke in inches, and the quotient will show nearly the average pressure on the piston throughout the stroke.

In our example, just given, the pressure is 120 pounds for each inch of the stroke, and the sum of these pressures is therefore 1,200 pounds. With the steam cut off at 10 inches, the steam at the end of the 11th inch occupies *eleven-tenths* of the space which it filled at 10 inches. Its pressure would, therefore, be *ten-elevenths* of 120 lbs., or 109.09 lbs. At the end of the 12th inch, the same steam occupies *twelve-tenths* of its original space, and its pressure is consequently *ten-twelfths* as great as 100 lbs. So on for each inch of the stroke, and the result is as follows:

10 inches, at 120 lbs. =	1,200.00 lbs.
1st inch after expansion	109.09 "
2d " " "	100.00 "
3d " " "	92.30 "
4th " " "	85.71 "
5th " " "	80.00 "
6th " " "	75.00 "
7th " " "	70.59 "
8th " " "	66.67 "
9th " " "	63.15 "
10th " " "	60.00 "
	2,002.51 lbs.

It is seen that every pound of pressure derived from the steam, after the closing of the steam port, is due wholly to expansion. If steam were non-expansive no more power would have been obtained after the closing of the steam port; but by its expansion we find a pressure of 100 lbs. per square inch of the piston at the end of the 12th inch, 80 lbs. at the end of the 15th inch, 67 lbs. at the end of the 18th inch, and 60 lbs. at the end of the stroke. The average of the pressure in the above table is 100 lbs. for each inch of the stroke, although the full pressure of the steam is but 120 lbs., and although but one-half of a cylinder of full pressure steam has been used. This great gain in effect could not be obtained from the steam without expanding it during one-half of the stroke; for with fresh steam behind the piston throughout the stroke, there could be no chance for expansion. It thus appears that, by expansion, the effect of *one-half* a cylinder of steam is *five-sixths* that of a full cylinder of steam of the same original pressure. The consumption of fuel being in proportion to the quantity of steam raised and used, it follows that by cutting off at one-half stroke, almost *five-sixths* of the effect of the full stroke is obtained with but one-half as much fuel.

The following table is derived from a "Table of Hyperbolic Logarithms." It contains numbers which may be employed to facilitate the calculation of the expansive action of steam. Its use, and the manner in which it is to be applied, will be duly shown:

No.	Log.	No.	Log.	No.	Log.
1.1	1.095	2.1	1.743	3.1	2.131
1.2	1.189	2.2	1.798	3.2	2.163
1.3	1.283	2.3	1.853	3.3	2.194
1.4	1.376	2.4	1.875	3.4	2.224
1.5	1.469	2.5	1.916	3.5	2.253
1.6	1.470	2.6	1.956	3.6	2.281
1.7	1.551	2.7	1.993	3.7	2.308
1.8	1.588	2.8	2.030	3.8	2.335
1.9	1.642	2.9	2.065	3.9	2.361
2.0	1.693	3.0	2.099	4.0	2.386

The columns headed "No." are numbers from 1 to 4, progressing by tenths. The logarithms are expressed in decimals for example, the logarithms of three is two and ninety-one thousands. The manner of using this table is as follows: Divide the whole stroke by the portion of the stroke before cutting off. Look in the table for the number corresponding nearest to quotient,

and note its logarithm. Multiply the original pressure of steam by this logarithm, and divide the product by the number opposite the logarithm, or the quotient as above found. The last quotient will show the average pressure on the piston throughout the stroke.

The use of the table is very simple. *Example.*—Original pressure of steam 120 lbs., cut off at eight inches of a 24-inch stroke. What is the average pressure throughout the stroke? 24 divided by 8 gives 3, the logarithm of which is 2.099. 120 multiplied by this number is 251.88, which, divided by 3, gives 83.96, or nearly 84 lbs. throughout the stroke. Where the average pressure is only in proportion to the amount of steam used, it could have been only 40 lbs., as one-third of 120 is 40. But by expansion during two-thirds of the stroke, the effect of the steam is doubled, one-third of a cylinder of steam doing more than two-thirds of the work of a full cylinder of steam.

CANAL TRANSPORTATION.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The question of the greater utilization of the canals by improved means of moving boats on them has lately particularly occupied the minds of State economists and inventors. The employment of animal power to tow a heavily-loaded boat, and even to transport passengers on canals, was looked upon formerly as a wonder, and we can hear our early Western settlers tell of their travels on canal boats. Now, even freight seeks quick dispatch, and immense sums have been invested to accomplish this by building railroads. As all improvements of practical value and service monopolize attention and means to their development and utilization and leave the old facilities in the background, so we find the splendid system of macadamized roads of the old country deserted, and the great movement of travel and freight on the railroads running alongside of them. Canals have had a similar experience: the railroads alongside carry the entire passenger traffic and the bulk of freight. Yet there is one advantageous feature in canal transportation, that is, the small resistance at a moderate speed, so that, for instance, at a speed of 2½ miles per hour only the same power is required to move 520 tons on a canal that is necessary to move 115 tons on a railroad, or 14 tons on turnpike; while at a speed of 5 miles per hour it moves 52 tons load on a canal against 57 tons on a railroad or 7 1-5 tons on a turnpike.

The resistance of the water against boats increases so that a speed of boats on canals above 5 miles per hour would not save in expenditure of power over railroad transportation; while at 4 miles per hour 102 tons on a canal stand against only 73 tons on a railroad, and such speed would be double the present speed of boats propelled by animals.

The superiority and cheapness of steam power over animal power has been so well established as to require no comparison here. As to the value of canal transportation, an article of Professor Tilman on "Improvements in Canal Navigation," published in the RAILROAD GAZETTE of September 10, 1870, as also the proceedings in the New York Assembly, last March, on the same subject, will give some insight into it, or at least an impression of its importance.

The means of applying steam power, suggested so far, may be placed under a few headings and treated in classes:

First.—Propellers—vessels provided with water-wheels or their equivalent seeking in the resistance of the water means of propulsion. By no mechanical contrivance can the entire power expended be utilized, and consequently some water will be displaced and moved without propelling effect, and produce unnecessary swell of the water and wash the banks. The boats by passing through the water will displace it, according to their shape and speed, so that, in that respect, only a moderate speed can be accomplished without washing the canal banks detrimentally.

Second.—Traction or road engines to take the place of the horses at present employed, to pull the boats by ropes likewise. This requires additional improvement in roads along the canals in place of the insufficient towpath, and also the raising and enlarging of bridges where at present the horses are passed over or around, and compels the transportation of the fuel and water used on the engine on a turnpike, with all the consequent disadvantages, and it may be almost impossible to provide for it now where canals pass through cities.

Third.—Stationary steam engines operating ropes or chains over drums and guides, or pistons in pneumatic tubes, on which canal boats may take hold by different devices.*

*Similar to the experiments made lately in New York on the Greenwich Street Elevated Railroad, or the first attempts in France with pneumatic railroads.

Fourth.—Motive power and driving mechanism on board a boat and connected therewith, so as to take hold by different devices on ropes or chains, or stationary rails, and to move the boat along those.†

J. H.

† Similar to the old chain or rope ferries, and to the experiments lately made in hauling boats on some European rivers. The plan of employing fixed rails, and, as it were, combine rail and canal transportation, may prove the most practical device. The patentee of one of these improvements in canal propulsion has commenced a series of scientific experiments and investigations, the results of these experiments in traction, which will be valuable for application in mechanics generally, will be ready for publication soon.

Will a Bench-Mark Grow?

ENGINEER'S OFFICE,
LOUISIANA & MISSOURI RIVER RAILROAD, }
April 10, 1871. }

TO THE EDITOR OF THE RAILROAD GAZETTE:

Allow me to refer to an article in your paper of April 1st, taken from *Engineering*. Daring as it may seem to doubt the infallibility of this celebrated journal, I still write to ask your opinion on the subject treated of in the above article. *Engineering* speaks of a bridge being built too high because the elevators were taken from a bench-mark which had, since it was established 20 years ago, grown 10 or 12 feet with the tree. Ever since the undersigned was engaged in surveying and engineering he has taken observations and has experimented so as to find out whether a bench-mark will grow with the tree or whether it remains stationary as to height. My experience goes to prove the latter. I, for example, never found the blazes in bearing trees, which had been hewn 20 to 40 years ago, out of convenient reach from the ground, which ought at least to be sufficient proof that a blaze or bench-mark will not grow ten or twelve feet, as *Engineering* says. Other observations, which would be too lengthy for description, have led to show that a bench-mark, if it grows at all, does not change its elevation to any perceptible degree.

C. E.

NEW ORLEANS CORRESPONDENCE.

Consolidation of Southern Sleeping-Car Lines under Pullman—Great Through Trains between New Orleans and New York—The Alabama & Chattanooga Railroad—Extension of the Jackson Road.

NEW ORLEANS, La., April 15, 1871.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Within the last hour some very important arrangements have been effected in railroad matters pertaining to this section of the country. The chief point is that the Pullman Company has effected a consolidation of sleeping-car interests, by which it will control all this class of accommodations on every Southern railroad. By the present arrangement, the late Rip Van Winkle, Crescent City and Pullman lines are consolidated under the name of the "Pullman Southern Car Company." A million of dollars actual paid subscription, and one million to be subscribed and applied as the increasing demands of the business require, to keep up and build the finest qualities of cars, form the capital of the enterprise. Mr. George M. Pullman is to be President, and E. H. Paine, Superintendent, with office at Louisville, Ky. With this tremendous power to operate their lines the management has a splendid field and profitable future in anticipation. Their announcement is to the effect that they will have as fine cars and splendid accommodations on their lines as there are in any other portion of the country. That this enterprise will well repay them, I am very certain, and wish them the utmost success.

In view of the fact that the season for the people of this section to take their flight to the mountains, springs and other places of resort will begin about the 1st of May, the railroad representatives are very busy in putting their claims before the public. Hence the rivalry is very lively between the numerous lines hence to the East, and all are offering a variety of inducements to secure the vast amount of summer travel which it is expected will move from this point.

As an item of unusual and special interest, I have assurances that a train of six sleepers, one hotel dining-car and sealed baggage car will begin to leave New Orleans about the middle of May, by way of the New Orleans, Jackson & Great Northern, the Mississippi Central, the Memphis & Louisville, the Louisville Bridge, and via Jeffersontown, Cambridge City, Columbus, Pittsburgh, Philadelphia, and the Camden & Amboy to New York. This train will leave every Saturday evening and run through without change, the car trucks being of an adjustable pattern, so that the change of gauge will be made at Louisville without causing any detention. The train will stop only at the largest cities and places of importance between this city and New York. This project is certainly one of the grandest railroad arrangements of this fast age. The intention is to run the train through to New York

in fifty-eight hours. A "big thing," and far ahead of all other competing lines at present.

The connections of Stanton's road in Alabama will positively be finished by the first of May. That part of the line from Elyton to Chattanooga is said to be one of the very finest roadbeds on this continent. Railroad men in whom I have great confidence say it is equal to the smoothest part of the Lake Shore track between Cleveland and Erie. Having made a survey of Stanton's line, I can truly say it lies along a route that is singularly and beautifully adapted to a fine roadbed. The very best quality of gravel lies at convenient points along the entire line, and this has been profusely used as ballast to make a road of unusual smoothness and solidity, which reflects great credit upon the man who has done more for the development of the railroad and industrial interests of Alabama than all its politicians. A Southern Car Company sleeper will run hence on the Jackson road, *via* Jackson, Meridian, Stanton's road to Chattanooga, Knoxville and Lynchburg on every evening train from the first of May.

The Legislature of Mississippi passed a bill last week the sharp provisions of which require that the New Orleans, Jackson & Great Northern Company shall build the road from Canton to Aberdeen within a certain specified time. A very considerable portion of the road is graded, though a large amount of heavy work will have to be done on it to repair the wear of weather that has occurred during the ten years since work was suspended on the line. It is understood that Mr. McCombs will go at work on it with his usual energy and push the enterprise to an early completion.

COUSIN NORMA.

A Colorado Railroad Center.

LONGMONT, Col., April 6, 1871.

TO THE EDITOR OF THE RAILROAD GAZETTE:

You will not find on any map, or on the post-office list, the name of the new town of Longmont, but as "not to know me argues yourself unknown," you know "Longmont" to be the town of the celebrated Chicago-Colorado Colony. As yet we have an abundance of vacant lots in and adjoining the site, but the few people now here see in the near future on this plat and its extended plains the metropolis of the Rocky Mountains. Your journal being devoted to railroad matters, I will not occupy your columns with the reasons why Longmont should grow great, except as these reasons are connected with your specialty. Denver City is the only rival which the engineer who laid out this country designed Longmont ever to have, and the former, lying about thirty miles distant to the south, has grown to its present strength and beauty from causes other than those arising from natural advantages. Owing to the necessity of irrigating the lands, towns cannot be located in Colorado, as in your States, wherever a surveyor can run straight lines, and comparatively few acres in proportion to the millions embraced in the boundaries of the territory will ever be subdued to the plow. In the vicinity of Longmont the mountain streams afford facilities for irrigation superior to any other district in the Territory. A line twenty-six miles long extended north and south through Longmont, parallel with the mountains, crosses six streams of water, having their unfailing sources in the summits of the snowy range, and from each of these water can be carried to thousands of acres of land of unsurpassed fertility. To the eastward, for hundreds of miles, are plains adapted to grazing, etc., covered with the nutritious buffalo grass. To the west, and in the mountains, which appear but a stone's throw distant, are the mining districts of Colorado, their treasures yet to be developed by energy, capital and skill. Old settlers who have traveled the mountains with weary feet in search of the golden prize, or trapping the beaver and mink, say that the most accessible route to the mining districts is up the "Left Hand," a small stream flowing past my doorway and coming from the mountains through a gap which can be plainly seen from here. Along the valley of that stream by an easy grade winds the road to the mines of Gold Hill, Ward District, Jim Creek, Cariboo, Wannemaker, Black Hawk, Georgetown and Central City, with many others less known, but rich in minerals, already affording employment to thousands of hardy and enterprising men. Of necessity, the miners are consumers, and the number of producers being limited by the comparatively few acres which can be cultivated must make farming a profitable employment and the new town the center of a large trade. As yet we are off the line of a railroad, but hope the evil will be of short duration. Our nearest railroad point is Erie, about 7 miles south, on the line from Denver to Boulder.

The coal fields in this vicinity, of a superior quality,

are exhaustless, and fuel being indispensable to mining operations, and timber on the mountains becoming scarce, a large business must eventually be done by some railroad company, either in transporting coal to the mines or in bringing the quartz containing the metals to the furnaces and smelting works, which will be established in the valleys near the coal banks. That would of itself be a large and profitable business, to say nothing of incidental transportation. The valley of the St. Vrain, where Longmont is situated, must at no distant day become the center of this trade, while the inhabitants of the valley would gladly welcome the incoming of any railroad. We hope it will not be many months until one is in operation from here to Pine Bluff, or one running north near the base of the mountains to connect with the Union Pacific. A company was organized some years ago for the purpose of building the road to Pine Bluff, but it was never worked. The founding of this colony must result in the rapid development of the St. Vrain Valley, and, as a consequence, the Pine Bluff project is again discussed by the people. The line is about 100 miles in length, running in a northeastwardly direction, passing near the thriving villages of Greeley and Evans, on the Denver Pacific Railroad, and over rich and extensive plains, and on as easy a railroad grade as is yet known in the valley of the Platte.

Please send on your capitalists, your railroad kings, your engineers, your contractors, your Heathen Chinee, your fish-plate, your locomotives and cars and help build the Pine Bluff road.

E. E. B.

RAILROAD LAW.

Passengers on Freight Trains.—A freight train that carries passengers is a passenger train, and is bound to protect passengers.

The defendant corporation saw a cattle train every afternoon between R. and S. with a passenger car attached. It stopped at all way stations and carried all passengers, no special application being necessary to secure passage. The conductor collected the usual fares, but no baggage was checked for that train, and it was stopped always in the proper position to water the engine, leaving the passenger car at some distance from the depot. The plaintiff, a passenger, while walking down the track to take the car, fell into a hole and was injured. Held, that the train was a passenger as well as a freight train, and that the defendant was bound to provide a safe way from the depot to the place where the car usually stopped. *Dillage vs. New York Central Railroad Company*, 66 Barb., 30.

Exemption from Taxation.—Notwithstanding charter exemption from taxation, held that a Legislature may impose a tax.

The charter of a railroad company, granted in 1852, provided that the railroad and its property should be exempt from taxation for fifteen years, and that thereafter the Legislature might "impose a tax not exceeding twenty-five cents per annum on each share of the capital stock held by individuals," whenever the annual profits exceeded eight per cent., which had never happened. Held, that the Legislature might, notwithstanding, in 1869, impose a tax upon the franchise, rolling stock and real estate of said company. The *Raleigh & Gaston Railroad Company vs. Reid*, 64 N. C., 155, and *Wilmington & Weldon Railroad Company vs. Reid*, Ibid., 266.

Precaution.—Companies not excused for using statutory precautions only.

A compliance on the part of a railroad corporation with a statute requiring the observance of certain precautions at the crossings of highways does not absolve it from observing such other precautions as reasonable care may require. Hence, held, that the question whether such a corporation was guilty of negligence in not employing a flagman at a certain crossing was properly submitted to the jury as a question of fact. *Webb vs. Portland & Kennebec Railroad Co.*, 57 Me., 117.

Eminent Domain.—Measure of damages for taken land.

Where part of a tract of land is taken without the owner's consent, for the construction of a railroad, the owner is entitled to be paid not only the value of the land actually taken, and damages for the depreciation in the value of the residue caused by the taking, but also for any depreciation caused by the use to which the land taken is appropriated. *Matter of the Utica & C. R. R. Co.*, 56 Barb., 456.

Fraudulent Delivery.—Carrier not liable for fraudulent delivery, if the goods are delivered to the consignee of record without negligence.

H. represented to plaintiff that he had obtained an order for goods from C. T. & Co., of 71 George street, Glasgow, and the plaintiff on the next day sent the goods by a carrier to that address. There was no such firm, but H. had made arrangements to receive at that place letters, etc., directed to it. The carrier, following the regular course of business, sent a notice to that address of the arrival of the goods. H. received the notice, indorsed it in the name of C. T. & Co., and so obtained the de-

livery of the goods which he applied to his own purposes. *Held*, that the carrier had delivered the goods to the person who represented himself to the plaintiff as C. T. & Co., and being guilty of no negligence, was not liable for their loss. *McKean vs. McFoor*, L. R., 6, Ex., 36.

Conditional Contract for Land and Right of Way.—Contracts may be made in England dependent upon the passage of an act of Parliament.

A railroad company being about to apply to Parliament for an act to make a branch railroad which was to pass through the plaintiff's land, agreed with him that, in the event of the bill being passed, they would purchase certain land of him for £2,000, and pay him £2,000 more for damages; and the plaintiff agreed that he would sell the land and would not oppose the passage of the bill. The bill passed, but the company did not take any of the plaintiff's land. *Held*, that the agreement was not *ultra vires*, being dependent on the passing of the act, therefore to be regarded as if made after it had been passed. *Taylor vs. Chichester & Midhurst Railroad Company*, L. R., 4 H. L., 628; S. C. L. R., 2 (Ex. Ch.) 565.

Leakage.—Carrier liable only for amount of leakage—Consignee must receive packages where there has been leakage.

The defendant, a common carrier, received a cask containing ten gallons of brandy for transportation to O. On the way it was injured, and when it was delivered to the consignee one gallon had leaked out. The consignee refused to receive it, and the consignor sued for the value of the cask and its contents. There being no claim that the nine gallons delivered were of any less value per gallon from the loss of the tenth, *held*, that it was the duty of the consignee to receive them, and that the plaintiff could recover only for the cask and the gallon lost. *Hove vs. Oswego & Syracuse Railroad Co.*, 56 Barb., 122.

Negligence.—*Expllosion of an engine prima facie of negligence, and company must prove that materials were good and workmen skillful.*

In an action against a railroad company to recover damages for injuries sustained from the explosion of an engine in a depot while the plaintiff by accident was standing, *held*, that the mere explosion was *prima facie* evidence of negligence on the part of defendants, to overcome which they must show that the material used in the engine were of the kind usually employed, that they had withstood the usual tests, and that the engine at the time was under the control of skillful persons. *Illinois Central Railroad Company vs. Phillips*, 49 Ill., 234.

Railroads in Florida are Public Works.

Two Justices of the Supreme Court of Florida (Hart and Wescott, J. J.), have given an opinion to Governor Reid, the gist of which is, that railroads are "public works" within the meaning of the Florida Constitution. This is doubtless an opinion of the majority of the Court, though it does not appear from the newspaper report whether this is so or not. The letter of inquiry concerning the point from the Governor is addressed to the Chief Justice but no opinion on his part is given.

Proximate Cause.—*Fire from sparks—Companies not liable for destruction of houses remote from track.*

The sparks from an engine, through defendant's negligence, set fire to a house from which the fire was communicated to another at some distance from it, which was consumed with its contents. *Held*, that the defendant was not liable for the damages to the last building. *Pennsylvania Railroad Company vs. Kerr*, 62 Penn., St. 353.

Loss by Fire.—*Goods lost by fire while being transported to Canada must be paid for in American dollars.*

In an action against a carrier to recover the value of goods delivered to him in New York, for transportation to Montreal, and destroyed by fire on the way, *held*, that the plaintiff should recover the amount in American dollars that the property was worth in Canadian dollars in Montreal on the day it was destroyed (Mullin, J., dissenting.) *Rice vs. Ontario Steamboat Co.*, 56 Barb., 384.

Payment of Income Tax on Anti-War Railroad Bonds.—*The Company may deduct the amount of tax from interest coupons.*

The case of *The Mayor and City Council of Baltimore vs. The Baltimore & Ohio Railroad Company*, involving the payment of the income tax on bonds, has just been decided by the Superior Court of the United States. The case was this: It appears that in 1854 the Baltimore & Ohio Railroad Company needed money to complete their road, and that the city of Baltimore, a principal stockholder, and vitally interested in the enterprise, was willing to lend the company for this purpose the sum of \$4,500,000. In order to raise the money the city issued six per cent. currency bonds for \$5,000,000 payable in 1890. The proceeds of these bonds, less ten per cent. reserved as a sinking fund, were paid over to the company, and the city took from it a mortgage on all its property to secure the payment of the principal and interest of the entire issue of bonds. In this mortgage is found the following defeasance clause: "And

"shall pay all and any expense incidental to the issue of any of the bonds, whether currency or sterling."

It is admitted that the company paid to the city, regularly as it accrued, the interest on the \$5,000,000 until after the passage of the internal revenue law of 1862, but since then has withheld the three per cent. income tax which the United States obliged it to pay. The position taken by the city is, that the company was bound to pay the full amount of interest without deduction, because of the words in the defeasance clause.

The court holds:—

1. That in a mortgage, given to secure the payment of certain bonds, where this clause was inserted, "And shall pay all and any expense incident to the issue of the bonds whether currency or sterling," it was held that, printing, clerk hire, stationery, advertising and similar matters were *expenses* incidental to the issue of the bonds, and that the mortgagor should pay them, but that this clause could not be extended to cover the income tax of three per cent. on all sums of money due for interest by a railroad company on its bonds, etc.

2. That at the date of the mortgage there was no tax of the kind, and no reasonable expectation of one, and to hold one of the parties responsible for contingencies not provided for, and not even anticipated when the contract was executed, would be to disregard instead of giving effect to the will of the parties.

3. That if there were injury at all, the city sustained it, and, as it did not avail itself of the privilege to sue, it cannot now litigate the legality of the tax with the railroad company; that this tax was exacted under color of law, and the company having notified the city of the demand of the United States, and the proceedings taken to enforce it, and having protested against its collection, were justified in paying it.

Loss by Fire.—*It is negligence to leave dried grass cuttings near the track.*

Servants of a railroad company left cut grass and hedge trimmings by the side of the railroad for a fortnight; the summer was exceedingly dry, and a fire caught near the rails shortly after the passing of two trains, and, a strong wind blowing at the time, ran across a stubble-field for two hundred yards, crossed a road, and set fire to the plaintiff's cottage. *Held*, that there was evidence for the jury that the defendants were negligent in removing the cuttings, and that the fire originated from sparks from the engine; also, that they were responsible for the natural consequences of their negligence, and the distance of the cottage from the point where the fire originated did not affect their liability. *Smith vs. London & Southwestern Railway Co.*, L. R., 6 C. P. (Ex. Ch.)

The Law Regulating the Transportation of Grain

The following is a copy of a bill which passed the Illinois Legislature, April 15, and has been approved by the Governor. It is to go into effect on the 1st of July next. The act is entitled "An act regulating the receiving, transportation and delivery of grain by railroad corporations, and defining the duties of such corporations with respect thereto":

SECTION 1. *Be it enacted by the people of the State of Illinois, represented in the General Assembly, That every railroad corporation, chartered by or organized under the laws of this State, or doing business within the limits of the same, when desired by any person wishing to ship any grain over its road, shall receive and transport such grain in bulk, within a reasonable time, and load the same either upon its track, at its depot, or at any warehouse adjoining its track, or side track, without distinction, discrimination or favor between one shipper and another, and without distinction or discrimination as to the manner in which such grain is offered to it for transportation, or as to the person, warehouse or place to whom or to which it may be consigned. And at the time such grain is received by it for transportation, such corporation shall carefully weigh the same, and issue to the shipper thereof a receipt or bill of lading for such grain, in which shall be stated the true and correct weight. And such corporation shall weigh out and deliver to such shipper, his consignee, or other person entitled to receive the same at the place of delivery, the full amount of such grain, without any deduction for leakage, shrinkage, or other loss in the quantity of the same. In default of such delivery, the corporation so failing to deliver the full amount of such grain, shall pay to the person entitled thereto the full market value of any such grain not delivered at the time and place when and where the same should have been delivered. If any such corporation shall, upon the receipt by it of any grain for transportation, neglect or refuse to weigh and receipt for the same, as aforesaid, the sworn statement of the shipper, or his agent having personal knowledge of the amount of grain so shipped, shall be taken as true, as to the amount so shipped; and in case of the neglect or refusal of any such corporation, upon the delivery by them of any grain, to weigh the same as aforesaid, the sworn statement of the person to whom the same was delivered, or his agent having personal knowledge of the weight thereof, shall be taken as true to the amount delivered; and if by such statements it shall appear that such corporation has failed to deliver the amount so shown to be shipped, such corporation shall be liable for the shortage, and shall pay to the person entitled thereto the full market value of such shortage, at the time and place when and where the same should have been delivered.*

Sec. 2. *At all stations or places from which the shipment of grain by the road of any such corporation shall have amounted, during the previous year, to fifty thousand bushels or more, such corporation shall erect and keep in good condition for use, and use in weighing grain to be shipped over its road, true and correct scales, of proper structure and capacity for the weighing of grain by car load, in their cars.*

After the same shall have been loaded, such corporation shall carefully and correctly weigh each car upon which grain shall be shipped from such place or station, both before and after the same is loaded, and ascertain and receipt for the true amount of grain so shipped. If any such corporation shall neglect or refuse to erect and keep in use such scales, or shall neglect or refuse to weigh, in the manner aforesaid, any grain shipped in bulk from any station or place, the sworn statement of the shipper, or his agent having personal knowledge of the amount of grain shipped, shall be taken as true as to the amount so shipped. In case any railroad corporation shall neglect or refuse to comply with any of the requirements of Sections 1, 2 and 5 of this act, it shall, in addition to the penalties therein provided, forfeit and pay for every such offense, and for each and every day such refusal or neglect is continued, the sum of \$100, to be recovered in an action of debt before any Justice of the Peace, in the name of the people of the State of Illinois, such penalty or forfeiture to be paid to the county in which the suit is brought; and shall also be required to pay all costs of prosecution, including such reasonable attorney's fees as may be assessed by the Justice before whom the case may be tried.

Sec. 3. Every railroad corporation which shall receive any grain in bulk for transportation to any place within the State, shall transport and deliver the same to any consignee, elevator, warehouse, or place to whom or to which it may be consigned or directed: *Provided*, such person, warehouse, or place can be reached by any track owned, leased or used, or which can be used by such corporation; and every such corporation shall permit connections to be made and maintained with its track to and from any and all public warehouses where grain is or may be stored. Any such corporation neglecting or refusing to comply with the requirements of this section, shall be liable to all persons injured thereby for all damages which they may sustain on that account, whether such damages result from any depreciation in the value of such property by such neglect or refusal to deliver such grain as directed, or in loss to the proprietor or manager of any public warehouse to which it is directed to be delivered, and costs of suit, including such reasonable attorney's fees as shall be taxed by the court. And in case of any second or later refusal of such railroad corporation to comply with the requirements of this section, such corporation shall be, by the court, in the action on which such failure or refusal shall be found, adjudged to pay for the use of the people of this State a sum of not less than one thousand dollars, nor more than five thousand dollars for each and every such failure or refusal, and this may be part of the judgment of the court in any second or later proceeding against such corporation. In case any railroad corporation shall be found guilty of having violated, failed, or omitted to observe and comply with the requirements of this section, or any part thereof, three or more times, it shall be lawful for any person interested to apply to a Court of Chancery, and obtain the appointment of a Receiver, to take charge of and manage such railroad corporation, until all damages, penalties, costs and expenses adjudged against such corporation for any and every violation shall, together with interest, be fully satisfied.

Sec. 4. All consignments of grain to any elevator or public warehouse shall be held to be temporary, and subject to change by the consignee or consignor at any time before the actual unloading of such property from the cars in which it is transported. Notice of any change in consignment may be served by the consignee on any agent of the railroad corporation having the property in possession, who may be in charge of the business of such corporation at the point where such property is to be delivered; and if, after such notice, and while the same remains uncancelled, such property is delivered in any way different from such altered or changed consignment, such railroad corporation shall, at the election of the consignee or person entitled to control such property, be deemed to have illegally appropriated such property to its own use, and shall be liable to pay the owner or consignee of such property double the value of the property so appropriated; and no extra charge shall be permitted by the corporation having the custody of such property, in consequence of such change of consignment.

Sec. 5. Any consignee or person entitled to receive the delivery of grain transported in bulk by any railroad, shall have twenty-four hours, free of expense, after actual notice of arrival by the corporation to the consignee, in which to remove the same from the cars of such railroad corporation, if he shall desire to receive it from the cars on the track; which twenty-four hours shall be held to embrace such time as the car containing such property is placed and kept by such corporation in a convenient and proper place for unloading. And it shall not be held to have been placed in a proper place for unloading, unless it can be reached, by the consignee or person entitled to receive it, with teams or other suitable means for removing the property from the car, and reasonably convenient to the depot of such railroad corporation, at which it is accustomed to receive and unload merchandise consigned to that station or place. Nothing herein contained, however, shall be held to authorize the changing of any consignment of grain, except as to the place at which it is to be delivered or unloaded; nor shall such change of consignment in any other way.

Sec. 6. Every railroad corporation organized or doing business under the laws of this State, or authority thereof, shall receive and deliver all grain consigned to its care for transportation at the crossings and junctions of all other railroads, canals and navigable rivers. Any violation of this section shall render any such railroad corporation subject to the same penalty as contained in Section 3 of this act.

Sec. 7. All laws in conflict with this act are hereby repealed.

—The St. Paul *Press* of April 11 says: "The steamer Diamond Joe, of the Fulton & St. Paul Line, made her appearance at our levee yesterday morning, being the first boat through the lake this season. The following table gives the name and date of arrival of the first local boat through Lake Pepin, for each season since 1860:

1860—Milwaukee	March 28
1861—Ocean Wave	April 8
1862—Keokuk	April 18
1863—Keokuk	April 6
1864—Hawkeye State	April 14
1865—Burlington	April 15
1866—Sucker State	April 19
1867—Itasca	April 21
1868—Phil Sheridan	April 4
1869—Sucker State	April 18
1870—Don Jasper	April 11
1871—Diamond Joe	April 10

"The last boat left last winter on the 5th day of December, thus showing a period of about 125 days in which through boats ceased to touch at this landing. Navigation, however, was really only closed for 110 days."

Chicago Railroad News.

Michigan Central.

The passenger business in both directions is quite light, while the receipts from freights have been such as to cause an increase of fifteen per cent. in the earnings for March, and an increase of twenty-five per cent. for the first week in April.

A Pullman drawing-room car is attached to the 9:00 a. m. New York express, and runs through to Rochester without change. The new Pullman "parlor cars" have been placed on the Great Western's train which connects with the night express leaving here at 9:00 p. m.

The Peteler Portable Railroad.

Most contractors must have heard of this invention, though many have never seen it; but it has been used for a year or two in this country—quite extensively in the East—and its value and the extent to which it is applicable have been pretty thoroughly established. The patent for the Northwest has been owned by a contractor, who heretofore has used it in his own business, but has not manufactured it or offered it to other contractors. Lately, however, he has been preparing to organize a company in Chicago for the manufacture and sale of track and cars in the Northwest, and, in order to exhibit the working of the system, has had a section of track and ten cars put into use on the improvement of S. J. Walker's property on the South Branch, near the corner of Twenty-second and Reuben streets, and close to the new bridge-building yard of Wells, French & Co.

The object of this portable railroad is to lessen the cost of transportation of earth, gravel, etc., on cuts and fills of railroads, and wherever such material is to be moved. It is evident enough, of course, that the same power will move a much larger load on a rail track than on an ordinary surface, and the problem consisted in contriving a sufficiently cheap and portable track, and a car adapted to such track and easily loaded and unloaded.

The track used here is formed of separate sections, 25 feet long. Each section consists of two 3 by 6-inch sleepers, 25 feet long, placed two feet apart and held together by four bolts of 1-inch iron. Close to the inner edge of the upper surface of each sleeper is riveted a rail of half-oval iron about $1\frac{1}{2}$ inches wide and $\frac{1}{2}$ inch high. These form a track of 20-inch gauge, the framework being equivalent to the road-bed and ties of an ordinary railroad. This section supplies a complete railroad 25 feet long. To make a longer line, the sections are placed on the surface of the ground end to end, and fastened together by hooks and eyes, dowel-joints, or otherwise. In road at Bridgeport there are castings at the ends of the sleepers, those at one end forming a mortise and those at the other a species of tenon with a hook, so that two adjoining sections are simply slipped together and are then latched. These sections can be readily handled, loaded and unloaded by three or four men, and four men can lay 1,000 feet in an hour. A few curved sections and one section with a frog and switch are needed with every lot. The track can thus be laid on almost any surface—or rough ground or in marshes—and a good road thus provided for vehicles.

These vehicles have iron flanged wheels 12 or 14 inches in diameter supporting a framework on which swings a hopper-like box, which can be turned over to either side. The sides are hinged at the top, and when the box is turned upon one side, that side falls, thus leaving it a box without a bottom, and the load is dumped. These cars are made to carry a cubic yard of earth, and they weigh about 350 pounds. Their sides are moderately low, so that they can be easily loaded. They are coupled together by chains and hooks.

At Bridgeport, the earth to be moved is dredged from the slips and emptied in heaps on the bank. At the bank there are two tracks for a few sections, one being a side-track. The cars are run in trains of five, hauled by one horse. When one train is loaded, the other is drawn up to the bank on the other track and left there while the horse is hitched to the loaded train and draws it to the low ground which is to be filled, where the cars are dumped one by one on the unfilled side of the track. When the ground parallel to the track has been filled a few feet, the track is moved upon the newly made ground, so that the earth is always dumped on the low ground where it is wanted.

Thus we have here one man and one horse hauling five such loads as usually require a man with a pair of horses for each—that is, a man and one horse do what, without the portable railroad, five men and ten horses do. It is common on railroad work to use a pair of horses and trains of twelve cars, by which a still greater economy is secured.

The portable track is sold in sections, ready for use, at one dollar per running foot, and the cars at eighty dollars each. At these rates, which are abundantly profitable to the manufacturer, it is claimed that any contractor can save their cost in three or four months of work. That there must be a large saving is unquestionable, and contractors can very readily estimate what it will be on inspection. The railroad may be seen in operation at the place named above, for a short time, and engineers and contractors will find it well worth their while to examine it. Its portability, adaptability to different surfaces and circumstances, its economy and its simplicity are evident.

Lake Shore & Michigan Southern.

Wall street has been constructing or inferring some sensational reports with relation to this road, one being that it will make a stock dividend of \$15,000,000 and another that it will soon be consolidated with the New York Central. The price of stock has reached 100% lately which hardly seems

high for a stock which ought to be able to earn 10 per cent. pretty regularly, just as it is.

Chicago & Northwestern.

Some changes in the time table of the Wisconsin Division will be made next week. Two additional local trains are to be put on, but their time is not yet arranged. On the Galena Division changes will be made to take effect on the 30th of this month.

On the Baraboo Air Line grading is in progress all along the line to very near Reedsburg. The iron for 20 miles of the road beyond Madison is on the way, and enough iron to lay the track to Reedsburg is purchased. The road will be ready for business as far as Reedsburg by the first of September or October next.

Illinois Central.

A new time table is soon to be issued to take effect the first Sunday in May, and arrangements will then probably be made to run through passenger cars between Chicago & Sioux City; running over the Northwestern road to Freeport, and thence by way of Dunleith and the company's Iowa line.

The new treasurer, Mr. Wm. K. Ackerman, has his office in this city for the present and will probably remain here until a local treasurer is appointed to take the position made vacant by his promotion.

ELECTIONS AND APPOINTMENTS.

—J. Edgar Thomson, Josiah Bacon, J. D. Cameron, Philip Gossler, Morris Hoopes, William J. Howard, C. S. Kaufmann, H. J. Lombaert, Wistar Morris, Joseph B. Myers, Thomas A. Scott, Edmund Smith and Jacob Tome have been elected directors of the Columbia & Port Deposit Railroad Company. J. Edgar Thomson is President.

—Mr. E. Ingalls, who has been both President (by the election of the directors) and Receiver (by appointment of a court) of the Indianapolis, Cincinnati & Lafayette Railroad Company, has sold out his stock and resigned his presidency, owing to a recent decision of Judge Cox to the effect that the President should not be a stockholder. Mr. Ingalls will remain Receiver of the company, and William A. Booth, of New York, has been chosen President in his place.

—Major James A. Burns has been appointed Superintendent of the New Brunswick & Albany Railroad.

—Mr. C. N. Stewart has been appointed Chief Engineer of the Rockford Central Railroad.

—Mr. A. Anderson, has resigned the general superintendence of the Kansas Pacific Railway, to become—it is reported—the Vice-President and General Manager of the Toledo, Wabash & Western Railway.

—Mr. Bowen, of the Northern Central Railway, has been appointed General Superintendent of the Kansas Pacific Railway. The Leavenworth *Times and Bulletin* says: "We believe the newly appointed superintendent is from Harrisburg, Pa., and was formerly connected with the Central Pacific Railroad. He is about 45 years of age, and a railroad man of ample experience."

—Mr. J. M. Keith has been appointed Master Mechanic of the Cincinnati & Indianapolis Junction Railroad Company in place of Mr. O. H. P. Little, resigned.

—Mr. Geo. A. Signor is appointed Road Master of the Cincinnati & Indianapolis Junction Railroad, a position resigned by Mr. Wm. Swan.

—Mr. Wm. K. Ackerman, until last week Local Treasurer in Chicago, of the Illinois Central Railroad Company, is appointed Treasurer of the company. The late Treasurer, Mr. Thomas E. Walker, whose office was in New York City, died on the 19th of April.

TRAFFIC AND EARNINGS.

—The Grand Trunk Railway advertises to carry grain in through cars from Chicago to Boston, Portland, and New England towns for 50 cents per hundred, which is at the rate of 30 cents per bushel for wheat and 28 cents for corn.

—We copy from the *Commercial and Financial Chronicle* the following tables of the earnings of such of the railroads of the country as make monthly reports, for the month of March and for the first quarter of 1870:

RAILROAD EARNINGS IN MARCH, 1871.				
	1871.	1870.	Inc.	Dec.
Central Pacific	\$578,870	\$482,000	\$96,870	...
Chicago & Alton	372,618	342,896	39,722	...
Clev'l'd, Col., Cin. & Ind.	850,135	674,148	175,987	...
Illinois Central	1,811,800	1,886,497	...	\$74,697
Marietta & Cincinnati	397,847	280,831	108,016	...
Michigan Central	1,336,430	1,047,510	289,871	...
Milwaukee & St. Paul	1,101,702	1,178,119	76,417	...
Ohio & Mississippi	789,196	668,087	121,049	...
Pacific of Missouri	734,982	765,188	40,226	...
St. Louis & Iron Mountain	393,297	290,429	102,798	...
Toledo, Wabash & West'n	1,087,430	846,786	240,834	...
Union Pacific	1,120,247	1,459,438	339,161	...
Total	\$12,271,688	\$11,341,494	\$1,460,735	\$50,511

EARNINGS FROM JAN. 1 TO APRIL 1.

	1871.	1870.	Inc.	Dec.
Central Pacific	\$1,602,328	\$1,295,612	\$306,716	...
Chicago & Alton	1,056,474	940,040	116,434	...
Clev'l'd, Col., Cin. & Ind.	850,135	674,148	175,987	...
Illinois Central	1,811,800	1,886,497	...	\$74,697
Marietta & Cincinnati	397,847	280,831	108,016	...
Michigan Central	1,336,430	1,047,510	289,871	...
Milwaukee & St. Paul	1,101,702	1,178,119	76,417	...
Ohio & Mississippi	789,196	668,087	121,049	...
Pacific of Missouri	734,982	765,188	40,226	...
St. Louis & Iron Mountain	393,297	290,429	102,798	...
Toledo, Wabash & West'n	1,087,430	846,786	240,834	...
Union Pacific	1,120,247	1,459,438	339,161	...
Total	\$12,271,688	\$11,341,494	\$1,460,735	\$50,511

—The traffic receipts of the Grand Trunk of Canada for the week ending March 25 amounted to £26,600, against £27,300 in the corresponding week of last year, showing a decrease of £700, or 3 per cent.

—The traffic receipts of the Great Western of Canada for the week ending March 24, amounted to £30,095, against £17,667 in the corresponding week of last year, showing an increase of £2,428, or 14 per cent.

MECHANICS AND ENGINEERING.

Heavy Blasting.

It is said that about thirty tons of powder and nine tons of nitro-glycerine have been used in a section of rock of one hundred rods long at East Hampton, on the Connecticut Air Line Railroad.

Elastic Iron Permanent Way.

Mr. John E. Lowe, of London, has invented an iron sleeper in which elasticity is sought by sustaining the rail on a plate or clip of wrought iron or steel which is cast into the sleeper over a trough-like hollow, and forms an elastic bridge seven or eight inches long, on which the rail rests.

Saco River Bridge.

Messrs. Clarke, Reeves & Co. have just completed, for the Portland & Ogdensburg Railroad Company, a bridge over the Saco River of 182 feet, single span. It is guaranteed to sustain a rolling load of one ton to one foot, and during the test, in which three locomotives, weighing in all 121 tons, passed over the bridge, the greatest deflection was one and one-sixteenth inches.

The Baldwin Locomotive Works.

These works now employ 2,020 men. Among the engines they have in progress are five for the Denver & Rio Grande Railroad, which is to have 3-feet gauge. Two of these are for passenger and three for freight service. The former will have four drivers and a single pair of truck wheels, the latter six drivers and a single pair of truck wheels.

Besides these, they have four mining engines of 3-feet gauge, and two light tank engines for the Coney Island Railroad, of Long Island, which is 4 feet $8\frac{1}{2}$ in. gauge. The relative weight of the latter engines, as compared with that of those for the 3-feet gauge, will furnish valuable data in the discussion of the gauges.

Pullman Cars on the Great Western Railway.

Two new palace cars, built by the Taunton Car Company, were last week placed on the Great Western Railway, to make daily trips between Hamilton and Suspension Bridge. The Hamilton *Times* gives the following account of them: "Each car is 62 feet long, and is divided into five compartments: one large drawing-room, which will comfortably accommodate 20 persons; two state-rooms, seated for six passengers each, and one room at each end of the car which may be used as a smoking-room. The easy arm-chairs in the latter are cushioned and incased in turkey morocco; the moveable chairs and settees in the drawing-room are in like manner enveloped in velvet plush, while the interior wood-work of the car is finished with gilding and rosewood veneering, in the highest and most costly style of the art. The windows are of the clearest French plate glass, 27x48 inches in size, and so numerous as to suggest a crystal palace. In case of a smash-up, the chances for egress may be considered good. In addition to the usual improved devices for heating and ventilating, providing with water, lighting with gas, etc., the partitions are so arranged that they may be closed or withdrawn at pleasure, while persons may readily pass from end to end of the car without going through the central apartments, but through a side passage for that purpose. In short, with the exception of a cupola, wine cellar, park and kitchen garden, nothing seems to be wanting to make the car in reality, as it is in name, a palace. "Leo" and "Mars"—for these are the pet names of the palaces—will not only outstrip all ordinary rivals on wheels, but may run a fair competition with the floating palaces on the lakes. The passion for travel is bad enough already, but if this multiplication of railroad conveniences is to be carried much farther, home will lose half its attractions, and no one will stay there who can afford to buy first-class comfort for three cents a mile."

* Approximate.



PUBLISHED EVERY SATURDAY.

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Editorial Announcements.

Correspondence.—We cordially invite the co-operation of the Railroad Public in affording us the material for a thorough and worthy Railroad paper. Railroad news, annual reports, notices of appointments, resignations, etc., and information concerning improvements will be gratefully received. We make it our business to inform the public concerning the progress of new lines, and are always glad to receive news of them.

Inventions.—Those who wish to make their inventions known to railroad men can have them fully described in the RAILROAD GAZETTE, if not previously published, FREE OF CHARGE. They are invited to send us drawings or models and specifications. When engravings are necessary the inventor is expected to furnish his own engravings or to pay for them.

Engineering and Mechanics.—Communications and correspondence relating to these subjects should be directed to M. N. Forney, No. 72 Broadway, New York. Subscriptions and advertisements will be received at the New York office, and any other business transacted with those to whom that office is most convenient.

Articles.—We desire articles relating to railroads, and, if acceptable, will pay liberally for them. Articles concerning railroad management, engineering, rolling stock and machinery, by men practically acquainted with these subjects, are especially desired.

Our Prospectus and Business Notices will be found on the last page.

THE BEST STYLE OF ENGINE FOR FREIGHT SERVICE.

The committee appointed by the Master Mechanics' Association to consider this subject made the following very brief report at the meeting held in Philadelphia last September.

"Your committee on 'The Best Style of Engine for Freight Service,' beg leave to report that what would be considered as the best style of engine for such service on roads with light grades and curvature would not be suitable for roads with sharp curves and heavy grades, and as all roads have their peculiarities to which the engines should be properly adapted, your committee would, in order to determine upon and recommend the best style of engine for freight service, desire to know for what kind of road—whether with or without heavy grades and curvature—also, what would be considered the maximum load for engines over such roads, and would respectfully ask for instructions and further time for the proper consideration of such an important and interesting subject."

This report was received and the committee reinforced by the addition of Messrs. Drippes, of the Pennsylvania Railroad, and Mitchell of the Lehigh Valley, and is expected to report at the next meeting.

It was somewhat curious that the two subjects which are now receiving more attention than any others elicited no discussion at all in the convention of master mechanics: we refer to that which forms the title of this article, and to "the dead weight of rolling stock." To some extent this may be attributable to their introduction at a very late period in the session of the Association, at a time when the members had become somewhat weary and anxious to get away; but probably much more to the fact that so great a diversity of opinion exists in regard to nearly all the questions involved, so that members felt some hesitation in expressing their opinions, knowing that so many others would probably differ from them in all that they might say. Human nature is prone to become conservative by experience, and to recognize the wisdom of the injunction "as far as possible live peaceably with all men,"

so that, unless there is some immediate and evident object to be gained by discussion, most persons will hesitate to express their sentiments very strongly among unsympathetic hearers, or those holding diverse opinions. We are all very apt to feel about a discussion as Josh Billings says about a fight, "that the only virtue in it is to lick the feller you're fighting." It is not pleasant to take the risk of losing one's virtue in either a fight or a discussion, and for this reason, probably, none of the members of the Master Mechanics' Association entered the lists against dead weight, or as the champion of any special form of freight locomotive. But even peace may be bought at too high a price, and a storm is better than stagnation. We are therefore disposed to believe that some animated dissension on the subjects we have named would have done good, if in no other way than by calling attention to their importance, and, in the case of useless dead weight, to the extent of the evil.

With reference to the best form of freight engine, it would, of course, be difficult to fix upon one which would meet all the varying conditions of different roads, grades, curves and traffic; but at the same time there are some general principles which should be observed under all circumstances, and from which, if once clearly established, it would not be difficult to deduce the form and proportions of an engine to meet the requirements of any ordinary road or traffic.

Take, for example, the weight which would be required on the driving wheels to draw a given load at a specified speed over certain grades or curves. By referring to Molesworth's Engineering Formulae, we find the resistance of trains on a level and straight line is given as follows:

Velocity of train, in miles, per hour	10	15	20	30	40	50	60	70
Resistance, in pounds, per ton...	8½	9½	10½	13½	17½	22½	29	36½

These data are the results of experiments tried on European railroads, and it by no means follows that they are correct for American roads and rolling stock, as it is quite probable that the resistance of our system of double—"bogie" or truck cars is not nearly so great as that of European "wagons" with rigid axles. We regret being obliged to make what should be to American engineers the rather humiliating confession, that there is no record of accurate experiments from which reliable data could be deduced with reference to this point. Therefore, before it will be possible to determine the weight which will be required on the driving wheels of locomotives, some carefully conducted experiments must be made and recorded, to give us the information which will be needed to determine this point. Could the Master Mechanics' Association do better than to undertake, through a committee, to make such experiments?

When once we know how much power will be required to draw a given load, it will be an easy matter to determine how much weight must be placed on the driving wheels. Having determined this, the maximum load which should be carried by each wheel on a rail of a given weight, must be considered.

Rankine's rule for the weight of rails, in pounds, per yard, is, that it should be equal to 15 multiplied by the greatest load on a driving-wheel, in tons (of 2,240 lbs.) An ordinary 30-ton engine with 10,000 pounds on each driving wheel would thus require rails weighing 67 pounds per yard, which is very much heavier than is ordinarily used in this country, and many engines with 10,000 pounds on each driving-wheel are running on 50 and 56-pound rails. That the practice is a very vicious one, a little reflection and some experience would soon show; but the question to be determined is, what proportion should the weight of the rails bear to that on the driving-wheels? Is Rankine's rule right? Let our master mechanics establish this point, and a very little figuring will then determine the weight of the rails or that on the driving-wheels for any given conditions. If we were called upon to make a rule deduced from American practice, we should say that the weight of the rail, in pounds, per yard, is equal to the greatest load on a driving-wheel, in tons (of 2,000 lbs.), multiplied by 12. It would, however, be very desirable to have the testimony of the Master Mechanics' Convention with reference to this matter.

The amount of dead weight carried is another question very closely allied to that of the weight of rail. In a paper* read before the New York Society of Practical Engineering, the statement was made that the weight of the tender and that portion of any ordinary engine carried on the truck amounted in the case of freight trains to 5 per cent. of the total gross weight, and in passenger trains to 20 per cent. In other words, 5 per cent. of the wear and tear to the track from

freight and 20 per cent. from passenger traffic is due to the dead or non-adhesive weight of the engine and tender. The reduction of this dead weight is therefore a matter of very great practical importance. It will be found on consideration that nearly all the principles involved in the construction of locomotives in some way relate to or affect it. For example, it would be an easy matter to place the whole weight of the engine, fuel and water on four, six, eight, or more driving wheels and connect them all together. If we do so, we encounter one of two difficulties—either that of overloading the driving wheels, or that of a wheel-base too short for steadiness, or too long and rigid to be able to pass through curves with ease—difficulties which were encountered in the very beginning of steam locomotion on railroads, and to obviate which the double-truck locomotive was proposed by Mr. Allen in 1830, and put into practice on the South Carolina Railroad in 1831; and the single-truck locomotive, designed by Mr. Jervis in 1831, and put on the Mohawk & Hudson Railroad in 1832. The latter plan is the one which has come into general use in this country, and the former, with some modification, that which has been revived by Mr. Fairlie, and the merits of which have been so ably discussed on the other side of the Atlantic. The degree of rigidity that is admissible in the wheel base of freight locomotives is a subject on which there is still much difference of opinion. In a report made to the North Missouri Railroad by Benjamin H. Latrobe, C. E., in 1866, and published in the RAILROAD GAZETTE of September 10, 1870, he argues very strongly in favor of using freight engines with all their wheels connected. He fortifies his reasoning with facts and figures, which are at least worthy of consideration by railroad men.

The number of wheels which can be connected together is a matter about which there might be much dispute. If we consult the practice in this country, we find that, in an overwhelming majority of cases, only two pairs of wheels are connected. In many cases ten-wheeled engines, with three pairs of wheels connected, have been altered so as to have only eight wheels, with only two pairs of drivers coupled. In building and equipping a new road it will often be a question whether it is best to lay down heavier rails or to connect more than four wheels. The degree of rigidity in the wheel base of a freight locomotive will be influenced very much by the amount of curvature in the line of a road. If, for example, it should be determined that a rigid wheel-base not exceeding 12 feet long could be used on roads with curves of 600 feet radius without injury to the rails, then for curves of 400 feet it would be a simple question of proportion, or $\frac{12 \times 400}{600} = \frac{8}{5}$ = the required length of wheel-base. It is true that the length of wheel-base which would not injure the track might be too short to give the requisite steadiness, and this, we believe has practically been the decision in relation to this question. But, as we stated before, it is still a disputed point. If it should be determined that some flexibility of the wheel-base is required, the question will come up whether a single truck will give all that is required, or whether a double truck, like the Allen or Fairlie system, will be needed. With a single truck the length of the wheel-base soon reaches a limit beyond which it is impracticable to extend it. The degree of curvature governs this as it does the length of the rigid wheel-base. With the double trucks there is no practical limit to the distance the wheel-base may be lengthened. Of course all these are to a very great extent questions of proportion only, but not, therefore, any the less important than if they were questions of principle. If it should be found that engines with rigid axles spread 12 feet could be run without injuring a given track, but that if they are further apart the rails and flanges would be very much worn, then it might be established that all locomotives whose capacity does not require a longer wheel-base than 12 feet might, for roads with the degree of curvature referred to, be built with all the axles fixed at right angles to the frames.

From such data, by a very simple calculation, we can decide how long a rigid wheel-base may be for any other road or curves. If a single-truck engine with, say, a 24-feet wheel-base, can be run without difficulty or injury on any given track, and it can be shown that engines whose wheels are further apart do injure the rails, then from the degree of curvature we can also calculate the length of engines for any other road, if its curves are known.

Having once established the amount of weight which will be required and which can be carried by the driving wheels on rails of a given size, and having determined the character of the wheel-base, the next question for consideration will be whether it is desirable or practicable to place all of it on the driving-wheels.

* Published in the RAILROAD GAZETTE of April 8th.

Inasmuch as the weight to be carried on them is limited, our engine, including boiler machinery, water and fuel, must not exceed the maximum weight on each wheel multiplied by the number of wheels. If these parts are made of the ordinary proportions and form of construction their weight will be very much greater than that which should be carried on four wheels, and therefore the number of driving wheels must be increased, which, unless they are very small, implies an extension of the wheel-base, with the attending difficulties, so that it becomes necessary to add either a tender for carrying the water and fuel, or a truck, or both, to the engine. While a tender will relieve the driving wheel of the weight of water, fuel and tanks, it does not help to steady the engine, whereas a truck attached to the frame of the engine lengthens the wheel-base, but at the same time gives it flexibility, and enables engines to pass around curves more easily. It would seem, then, that of the two, a truck would be preferable for carrying a part of the weight. It must then be determined which parts of the locomotive should be carried by the driving-wheels and which by the truck. Inasmuch as the weight of the driving-wheels is limited by the weight of the rails, and as it is always desirable to have as much adhesion as possible, it obviously would seem that the water and fuel, which vary in quantity, should not be carried by the driving-wheels. If, for example, we have rails which will bear 10,000 lbs. per wheel, and an engine with four driving-wheels, then if we carry 1,500 gallons of water and 2½ tons of coal, we would, with a full supply of each, have 40,000 lbs. of adhesion; whereas, when the fuel and water are both consumed, we would have only 22,500 lbs. for adhesion. If we put 40,000 lbs. of permanent load on the driving-wheels, and then add the water and fuel to it, each wheel will at times have 14,375 lbs. weight on it—a load which would injure the rails very seriously if the latter are proportioned to bear only 10,000 lbs. If the parts of a locomotive are proportioned and constructed as they usually are, it will then be found difficult, even with the addition of a truck, to carry all the weight of boiler machinery, water and fuel, without adding a tender, or else increasing the number of driving-wheels and extending the wheel-base longer than is practicable. The proportion of the different parts of a freight locomotive is, therefore, an important consideration in this connection. Take, for example, the driving-wheels and cylinders and their connections. The larger the wheels the larger must be the cylinders, and consequently the other parts. As we have found that considerable confusion exists in the minds of some persons in regard to the relative proportion of the cylinders to the wheels, we will give the subject a little consideration here.

If we take an ordinary 30-ton, eight-wheeled locomotive, with four driving-wheels, say 6½ inches in diameter, and with 16x24-inch cylinders, we find that the circumference of the wheels is 193.2 inches, and therefore the locomotive will advance that distance on the track for each revolution of the wheels, provided they do not slip. Each cylinder will be filled twice with steam, which will amount to 19,301 cubic inches consumed, for each revolution, or within a small fraction of 100 cubic inches of steam for each inch the engine moves on the track. From this it might be inferred that with 4,000 pounds weight on the driving-wheels we should have a consumption of steam equal to 100 cubic inches for each inch in circumference of the driving wheels, or each inch the locomotive moves. From this the following rule may be deduced to get the capacity of the cylinder: Multiply the total weight on the driving-wheels in tons (of 2,000 lbs.) by 5, and then by the circumference of the wheels, in inches, and divide by 4. The result will be the capacity in cubic inches of each cylinder.

To get the stroke, divide the capacity by the area of the piston, in inches; or to get the area of piston, divide by the stroke, in inches. Suppose we apply this rule to an engine with 40,000 lbs. or 20 tons weight on four 50-inch driving-wheels whose circumference is equal to 157 inches. $20 \times 5 \times \frac{157}{4} = 3,925$. If we take the stroke at 22 in. and divide 3,925 by it, we will have the area of piston = 178.4, or very nearly that due to 15 in. diameter. Therefore an engine with 50-in. wheels and 15x22-in. cylinder would have as much tractive power as one with what are called 5-ft. wheels and 16x24-in. cylinders. Of course a wheel 50 in. in diameter will not weigh so much as one 5 ft. nor a cylinder 15x22 in. as much as one 16x24 in., nor will the one require so strong a piston or connecting rod, guides, cross-heads, frames, bed-plates, etc. Therefore, we see that by reducing the diameter of the wheels we can reduce the weight, and yet not affect the power of the engine.

It is, of course, immaterial whether the weight is carried on four or six or more wheels, as the same cylinder capacity would be necessary in either case. The size and capacity of the boiler should also be based upon the weight on the driving-wheels and not on the size of the cylinder; because, in the examples just referred to, the cylinders would consume the same quantity of steam, although those for one engine were considerably larger than for the other. Therefore, the amount of heating surface and area of grate should be in proportion to the adhesive weight. What this proportion should be, would be an interesting inquiry for the "Committee on the Best Style of Engine for Freight Service."

Referring again to ordinary 30-ton engines, we find that they have about 1,000 square feet of heating surface, or 50 feet for each ton on the driving-wheels, which is a good rough rule, but one about which there might be much difference of opinion.

To review what we have said, and to suggest what seem pertinent subjects for investigation in this connection, we will venture to put the substance of what we have written in the form of questions for the consideration of master mechanics and railroad men.

First.—What is the resistance per ton of American rolling stock at different speeds, tested by actual experiment?

Second.—What proportion should the maximum weight on a driving-wheel bear to the weight of iron rails per yard, and what to steel rails?

Third.—How long can be the wheel-base of a locomotive whose axles are held rigidly at right angles to the frames, on curves of any given radius, without injury to the track?

Fourth.—How long may the wheel-base of a locomotive with one truck be without causing difficulty in passing through curves of a given radius?

Fifth.—Is it desirable to adopt the double-truck or "bogie" system to secure greater flexibility of the wheel-base; if so, under what conditions?

Sixth.—How many pairs of driving wheels can be connected together to advantage?

Seventh.—Is there any objection to carrying the fuel and water on the driving-wheels?

Eighth.—What proportion should the capacity of the cylinders bear to the weight on the driving-wheels?

Ninth.—What should determine the diameter of the driving-wheels, and why?

Tenth.—What amount of heating and how much grate surface should there be for each ton on the driving-wheels for burning wood, bituminous and anthracite coal, respectively?

Eleventh.—How can the dead weight be reduced without injury to the efficiency of the engine?

If these inquiries were once conclusively determined, it would not be difficult to design an engine for almost any traffic.

PRICES OF SEASON TICKETS.

A petition was recently presented to the Massachusetts Legislature asking for a general law to regulate the rate of reduction of season tickets on railroads below the usual fares. The petitioners complained that the prices of these tickets were not in proportion to the distances, and desired a law establishing something like *pro rata* charges. Tickets for one mile, it was said, were sold for \$7 per quarter, while for eight miles the price was only \$15, and for twenty-five miles \$30 per quarter.

The committee to which this petition was referred in their turn referred it to the State Railroad Commissioners, who gave a hearing to the petitioners and then made a report. They first consider the question "whether the amounts generally charged for season tickets over short distances on the roads of the State are in themselves excessive." They find that the charge complained of which was \$9 per quarter for three miles, or 72 cents per week, is as low as it has ever been, or as is usual in the State, either on horse or steam railroads. An experimental system of cheap workingmen's trains by which passengers may be carried for 50 cents per week has been proposed in Massachusetts, and it is hoped and by many believed that it will be successful; but the Commissioners recognize that this is as yet an untried experiment, and that, however hopeful, it is not proper to base legislation upon it.

The Commissioners next consider the question, "can the rate named be considered excessive as compared with the rates charged for longer distances?" The discussion of this question is worth the attention of railroad companies with a considerable suburban traffic, which do not always fix their rates according to the cost of transportation.

The Commissioners say, very truly, that "practically it costs as much to draw a passenger a part as the

whole of the route. The difference between hauling an empty seat and a seat with a passenger in it would not probably exceed one-third of one mill per mile."

The truth is, the business of a suburban train should be considered as wholly a through business between the terminal stations of the route. Exactly the same accommodations are provided for the man who rides to and from Twenty-second street on the Hyde Park trains of the Illinois Central as for him who rides to and from Hyde Park. The train capacity is governed entirely by the number of seats needed between the Central Depot and the nearest station. No allowance is made for passengers who get on at one way station and off at another; for there are none—or next to none. When a passenger leaves the train at Twenty-second street or Douglas place it is almost certain that no one will get on to take his place. This causes a radical difference between the suburban and the ordinary local traffic of the road. When a passenger leaves the train from Chicago to Cairo 50 miles from this city, it is quite probable that there, or nearby, some one will get on and take his seat, and the same seat may be occupied by half-a-dozen passengers between Chicago and Cairo. So on this train it is proper that the rates should bear some proportion to the distance. With suburban trains, on the contrary, we believe that rates should be nearly the same to all points on the route. We speak here of strictly suburban trains, and not of those which run 30 or 40 miles, and, of course, have some way business.

Our Chicago suburbs have two great faults: first, there are too many of them; and second, they are too far apart. With eight or ten considerable villages on one railroad within twenty miles of the city, a frequent train service might be supported at low rates—at uniform rates—so that the only disadvantage of the most distant town would be the longer time of the trip to the city.

Uniform rates for all distances on a horse railroad are almost universal, and seem to meet no opposition; but there is a considerable way business on such roads, and some thinly peopled, distant districts have special cars for their accommodation, for which, however, they pay no extra price. It is the difficulty of collecting fares proportioned to the distances, rather than any injustice in so doing, that has made it the custom to charge equal rates for long and short distances on street railroads; with suburban trains such rates are only just.

THE INDIANA RAILROAD AID LAW.

The Legislature of Indiana, in May, 1869, passed an "Act to Authorize Aid to the Construction of Railroads by Counties and Townships Taking Stock in and Making Donations to Railroad Companies."

The provisions of this law authorize one hundred freeholders of the county, or twenty-five of any township, to petition the Board of County Commissioners to make an appropriation of money to any named and duly organized railroad company, to aid in the construction of a road through such county or township, as the case may be, by taking stock, or as a donation, to any amount not exceeding two per cent. of the taxables of the county or township; upon this petition the Commissioners are required to order the polls at the several voting places opened upon a given day, not less than thirty nor more than sixty days thereafter; notices are to be published and posted, and the ballots of the legal voters taken "for the railroad appropriation" or "against the railroad appropriation"; and if the returns show a majority in favor of the aid, then the Commissioners are to assess a tax for that purpose, of at least one-half the sum voted, at their ensuing June session. If the aid voted for is not to exceed one per cent. of the taxables, all is to be assessed the first year; but if it is greater than that sum then one-half is to be assessed the first year and the residue the ensuing year.

The law further provides that but two per centum of the taxables can be appropriated in favor of any one railroad, and not to exceed one per centum can be raised for railroad purposes in any one year. After the money is collected the Commissioners may subscribe and pay for stock at the time, or they may in their discretion make an outright donation, and pay money over from time to time; but if they donate they cannot do so faster than the railroad company to be aided has done and paid for work in the county or township equal in amount to the donation then made, nor can to exceed one-half the appropriation be paid over until the road is completed and is running through the county or township.

The Lafayette, Muncie & Bloomington Railroad Company, having located its line through the counties of Delaware, Tipton, Clinton, Tippecanoe and Benton,

votes were taken therein in August, 1869, under this law, and aid voted to the amount of \$660,000; that in Tippecanoe being \$372,000, to be taken as stock.

Frederick Geiger, a tax-payer, brought his suit to enjoin the Auditor of Tippecanoe County from placing upon the tax duplicate for 1870 any part of this tax, which had been ordered by the County Commissioners to be assessed pursuant to this vote, upon two alleged grounds: 1st, that the law authorizing the aid was unconstitutional; 2d, that the proceedings under it were irregular and fatally defective. The Common Pleas Court granted an injunction, from which an appeal was taken to the Supreme Court. The case—which was a test one—was submitted on the 3d inst., after elaborate oral arguments had been heard from both sides, upon voluminous printed briefs, in which the constitutionality of the law and the regularity of the proceedings were thoroughly discussed.

The case was decided on the 12th inst., in favor of the railroad company throughout, and reversing the judgment below.

From the very lengthy opinion of Judge Buskirk (which seems to have been justified by the importance of the case) we condense the following as the material points decided:

1. That the Constitution of Indiana authorizes the Legislature to empower counties to aid in the construction of railroads by taking stock in the companies engaged in constructing them, provided the money is paid when the stock is taken, as the Constitution of the State requires.

2. That the right to take stock implies the power to levy a tax to raise money to pay for it.

3. That the act is in force all over the State, and the submission of the question of making the appropriation to the voters is a mere mode of putting the same into execution and of determining whether or not the county or township will avail itself of the privileges it confers.

4. That a tax to take stock in aid of a railroad running through a county or township is for a public local purpose and valid.

5. That the change of voting places two days before the vote was taken by the County Commissioners who have the establishing of such places, in the absence of an allegation in the complaint that the change was fraudulent, or that voters were thereby prevented from voting, was not illegal, and did not vitiate the proceedings.

6. That the failure or refusal of an inspector of the election to make a return of the vote of his poll will not invalidate the proceedings when it is affirmatively shown that such unreturned vote would not have changed the result.

7. That the announcing of a determination of the County Commissioners, when submitting the question of the appropriation to the voters, that if voted for it will be made for stock and not by way of donation, is premature—the law contemplating that the mode of rendering the aid shall be determined by the Commissioners *after* the money is collected; but the favorable vote upon such a submission of the proposition must be held advisory only, and therefore not binding so as to invalidate the proceedings.

Upon the constitutionality of the donation provision of the law, the Court decline to decide at present. There is, however, an intimation that Judge Buskirk is of opinion that it cannot be sustained. It is understood that other pending cases will raise this point directly, and it will then be seen whether Indiana will follow the Michigan decision, holding taxes levied to make donations to railroad companies unconstitutional, or that recently made in Iowa, which holds them valid.

The Transportation of Grain.

We publish elsewhere the new law of Illinois regulating the transportation of grain in bulk. The first section requires that grain shall be received and transported from any depot or warehouse on its line, for all parties, without distinction or discrimination, and that the railroad company shall be responsible for the delivery of the full amount received at any place on its line to which it may be consigned.

The second section requires that at every station where as much as 50,000 bushels of grain was shipped the previous year, the railroad company shall keep scales for weighing grain by the car-load in cars, under penalty of a fine.

The third section requires that every company shall deliver grain in bulk to any elevator, warehouse or other place, on any track controlled by the company, or any other track which it has permission to use, and that it shall permit connections to be made with its track from any public grain warehouse.

Neglect so to do renders the company responsible for

all damages and costs of proceeding in the first; suit in the second, to a fine of from \$1,000 to \$5,000, and in the third, to a transfer of its property to a receiver until all damages, charges and fines are paid.

The third section declares that the consignee or consigner may change the destination of any consignment at any time before it is unloaded.

The fifth section gives the consignee the right to remove grain from the cars at any time within twenty-four hours after notice of arrival, and after the car has been placed where it can be conveniently approached for unloading, and near the depot, without extra charge.

The sixth section requires railroad companies to deliver grain to any intersecting railroad, canal, or navigable stream to which it may be consigned.

The seventh section repeals conflicting laws.

New York and Chicago.

The Chicago *Tribune* proposes to cheapen transportation and enrich capitalists by inducing the latter to construct a new double-track steel-rail road between New York and Chicago, which, it says, could be done (the construction of the railroad, not the inducing of the capitalists) for \$25,000,000, and would be very profitable competing against lines with a nominal capital of \$75,000,000. We have not the least doubt that it will be easy to find capitalists who will jump at the chance to get such a railroad for \$25,000,000. Indeed, the rails alone would cost about \$19,000,000, the ground necessary for depots and the termini and the necessary depots in those cities alone would be worth something like a million, and for the rest—the grading, bridges, tunnels, way stations, right of way, shops, rolling stock, etc.—certainly five millions would be dirt-cheap. Indeed, we believe the equipment of the New York Central & Hudson River road alone is worth, at a moderate valuation, twice that amount.

But our capitalists, even when offered such a wonderful bargain, will probably remember that they cannot expect more than a fourth of the business to New York, because there are already three good lines which will doubtless continue to carry freight and passengers, notwithstanding the cheap \$25,000,000 line because they will prefer something to nothing, and if they can't earn ten per cent. dividends they will try to make at least one per cent. Still, if the railroad is constructed and offered at that price, we are confident that there will be customers for it.

A New Pacific Railroad.

It is a fact not generally known in this country that another railroad from the Atlantic to the Pacific is well under way and will probably be completed this year. This is the Honduras Interoceanic Railroad, nearly one-half of which was to be completed by the 1st of May. This railroad will extend from Port Cortez, in the Bay of Honduras, nearly due south 100 miles to the Bay of Fonseca on the Pacific coast.

Port Cortez is due south from Chicago, and eighteen or nineteen hundred miles distant—that is, nine hundred or a thousand miles from New Orleans. It is four or five hundred miles north from Aspinwall. The Bay of Fonseca is eight or nine hundred miles nearer to San Francisco than is Panama, so the entire sea voyage between New Orleans and San Francisco by the Honduras route will be about 1,200 miles less than by the Panama route. The difference is not so great from New York, Aspinwall being but little further from that city than Cortez. The new railroad runs through a fertile and productive though poorly cultivated country, and it is likely to develop a considerable traffic, especially in valuable woods. The climate of Honduras is absolutely temperate, although it is in the tropics, the most of the country being at a considerable elevation above the sea, and the proximity of the two oceans affording frequent sea breezes.

The Darlen Canal.

Correspondence from persons accompanying the United States expedition now exploring the Isthmus of Darien for a practicable route for a canal between the Atlantic and the Pacific repeats the assertion made by Commodore Selfridge some months ago, that such a route has been discovered. To those who do not understand the somewhat complicated topography of the isthmus, we would say, that the Gulf of Darien is on the Atlantic coast, and the Gulf of San Miguel is nearly due west of it on the Pacific coast, and distant about 80 miles. The two gulfs are not quite opposite, however, as the isthmus extends from the northwest to the southeast, and the most direct line across it from the Gulf of Darien would extend in a southwesterly direction. Into the Gulf of Darien the River Truando enters, flowing directly northward, and navigable for some

distance. The River Tuyra flows from the interior northwestward, or nearly parallel with the general axis of the isthmus into the Gulf of San Miguel. It is navigable for twenty miles or more. If we suppose a line drawn from the Gulf of Darien to the Gulf of San Miguel to be the base of a right-angle triangle, then the River Tuyra will be the hypotenuse, and the River Truando the other side. Of course the two rivers do not form a junction in the upper parts of their courses so as to complete the triangle absolutely, but they approach each other, and the exploring party reports that a practicable route for a connecting canal, with an elevation probably of not more than 300 feet above the sea, exists along a tributary of the Tuyra, running westward, which will carry it nearly to the valley of the Truando, where there is no considerable elevation separating them.

A Great Suburban Traffic.

We notice that on the Philadelphia, Germantown & Morristown Railroad, recently absorbed by the Philadelphia & Reading, preparations have been made for an immense summer suburban traffic. The road really consists of two short lines extending northwestward from Philadelphia, only four miles of which, within the city, is in common. On this four miles of "trunk line," there are *ninety-six* trains daily—forty-eight each way. Twenty-nine run on the line to Morristown, which is seventeen miles long, and nineteen on the line to Germantown and Chestnut Hill, which extends about eleven miles from the station at the corner of Ninth and Green streets. Twenty one additional trains were put on the road on the 3d inst. There are now twenty trains each way on Sunday.

It is by such accommodations as these that a town becomes truly suburban. When a lady can go into the city for an hour or two to make a call or go shopping; when evening visits can be made; when concerts, theatres, lectures, and other evening gatherings are accessible to families in the suburb; and when they can have the advantages of city churches and schools, then the attractions of suburban life have scarcely any drawbacks. These depend chiefly on the frequency and speed of trains.

On the other hand, this great train accommodation will be unprofitable without a very large suburban traffic, such as can hardly be hoped for in a city of over half a million people when the suburban towns are on eight or ten different railroad lines.

The Texas Pacific Railroad.

A meeting of the corporators of this company, which Congress has authorized and provided with a land grant to construct a new railroad to the Pacific near the 32d parallel, was held in New York on the 14th inst. Of the 123 corporators named in the bill, residents of nearly every section of the Union, only ten or twelve were absent. Of the 20,000 shares representing \$2,000,000, more than the necessary 10 per cent. was paid in.

It is said that there were two well defined parties among the incorporators, one of which desired to make Marshall O. Roberts, and the other Thomas A. Scott, President. The meeting of incorporators was private, but it has been reported that the party in favor of Mr. Roberts was found to be the strongest, and that it proposed to make Samuel Sloan, President of the Delaware, Lackawanna & Western Company, Treasurer of the company, though the election was postponed for a few weeks.

The new company will receive no subsidy in bonds, and its land grant is less liberal—not to say extravagant—than that of the Northern Pacific, but it is a great advantage that the country on its line nearly the entire distance across Texas, for several hundred miles, is exceedingly fertile and productive, is already attracting a heavy immigration, and will supply a very large traffic, so that the road is likely to find business from the first, and to be a valuable property before it is half completed. From the Rio Grande to San Diego it will have its full share of poor land, uninhabited and in large part uninhabitable; but its Texas line will offset many drawbacks.

Congressman Marshall has introduced a bill to promote commerce among the States and to cheapen transportation. It provides for the construction of two tunnels at Cairo, one under the Ohio and one under the Mississippi River, to be used for connecting the railroads which do now or may hereafter center at or near the junction of the Ohio and Mississippi rivers. The company to be incorporated under the bill is entitled the Mississippi & Ohio Tunnel and Lake Company. Capital stock, ten millions of dollars. The list of incorporators embraces well-known Chicago, St. Louis and Cincinnati capitalists.

General Railroad News.

OLD AND NEW ROADS.

California Railroads.

In January it was announced that the California & Oregon branch of the Central Pacific Railroad would be pushed through to the Oregon line this year. The *Shasta Courier*, of March 11, states that Hood's party having completed and corrected the preliminary survey from Tehama County, through Shasta and Siskiyou to the boundary, have been discharged.

The San Francisco & Northern Pacific Railroad Company are pushing the grading on the line from Santa Rosa to Healdsburg, and it is stated that the cars will be running as far as Healdsburg by next June. The California Pacific have also commenced work on a branch of their road to run through Sonoma County. They began at Santa Rosa, to run up north, and statements are made that the line will reach Cloverdale this season. From Santa Rosa it will run south to Sonoma, and thence to Vallejo, possibly *via* Napa. This will give Sonoma two roads.

The Vacca Valley road may be extended up north to Pleasant Valley and thence possibly to Putah Creek and beyond. The suggestion has been mad, but no definite steps have yet been taken as far as known.

The Central Pacific surveying party are still at work on the short route from Sacramento to San Francisco. The *Contra Costa Gazette*, of March 11, reports them as being on the route from Bay Point to Moraga Valley.

The San Lorenzo Valley Railroad Company was incorporated on the 11th ult. A road is to be built from Santa Cruz up the Lorenzo Valley and over to Santa Clara Valley. The connection of San Jose with Alviso and Deep Water has long been talked of, and it is said that the California Pacific intend taking hold of the project.

The Stockton & Copperopolis road has been pushing forward. The first passenger train was run as far as Petersburg, 14 miles, February 22. Ten miles out of Stockton is Holden, from which place it is intended to run a branch, 23 miles long, to Ione city, Amador County. The matter is being earnestly agitated.

The citizens of Antioch sent out early in February a party to survey a route from Antioch to Visalia, Tulare County. The party reached Visalia on the 10th inst. The route surveyed is stated as almost an air-line from Antioch to Watson's Ferry, on the San Joaquin Slough, and thence pretty direct to Visalia. The grade is given as very easy.

The Central Pacific Company is reported as about to recommence work on the San Joaquin Valley road, which has stopped at Modesto. There are rumors that it will reach Bear Creek within three months.

The Southern Pacific of California is running now from San Francisco to Gilroy, 80 miles, and large quantities of iron are reported on the way for its continuation. It is stated that 20 miles more will be completed by July.

It is proposed to build a narrow-gauge road from San Francisco to Menlo Park, about 30 miles. The *San Francisco News Letter* learns from reliable sources that E. N. Robinson is organizing an engineering party to locate a narrow-gauge road from San Francisco down the coast to San Diego.

The survey of the proposed road from Nevada and Grass Valley to Marysville was commenced on February 16, under charge of Mr. R. L. Harvis, one of the best engineers on the coast. The grades, as far as the survey has gone, are reported to vary from 35 to 116 feet. On the 18th ult. the survey was carried from Grass Valley as far as the county line.—*Scientific Press*.

Leavenworth Bridge.

On the 15th inst. all the piers for this Missouri River bridge were completed. They are founded on the rock 60 feet below the bed of the river.

Chicago & Southwestern.

The section of this road between Leavenworth and Cameron, Mo., about 48 miles long, was formally opened with an excursion on the 13th inst.

Hastings & Dakota.

The contract for the construction of the road-bed for twenty miles beyond the present terminus was let, on the 12th inst., to Messrs. Langdon & Linton, the contractors on the St. Paul & Chicago Railway. They are to have it ready for the rails by the 10th of September next.

Nevada Railroads.

Nevada, having obtained Legislative permission to construct narrow-gauge roads, is preparing to have quite a number. The *White Pine News*, of the 8th ult., reported a surveying party already at work on the proposed road from Elko to Hamilton. The *Eureka Senti-*

nel thinks it very possible that the road from Palisade to Eureka will be finished by next September. The survey is to be commenced immediately. A road from Mill City to Unionville, Humboldt County, 20 miles, will be built, we are told. The survey from the road between Reno and Virginia City was commenced February 24. Special franchises have been granted to all these narrow-gauge roads, and hereafter the gauge is not limited for other roads. The *Carson Register* says that steps are being taken to continue the Virginia & Truckee Railroad from Carson to Reno, *via* Washoe.

St. Louis & Southeastern.

By the articles of consolidation of this and the Evansville, Carmi & Paducah Railroad, filed in Indianapolis on the 15th inst., the capital stock of the consolidated company is fixed at \$10,000,000, divided into shares of \$100 each. Of the amount, \$4,500,000 is to be known as preferred stock. Of the balance, the present stockholders of the St. Louis & Southeastern Railroad Company are entitled to 7,447 shares, and the stockholders of the Evansville, Carmi & Paducah Railroad Company to 5,925 shares.

Rockford Central.

The Vice-President of the company has been conferring with Mr. S. S. Merrill, General Manager of the Milwaukee & St. Paul and Vice-President of the Western Union railroads, in reference to building the Rockford road to Rockton and having the Western Union Company operate it. Mr. Merrill writes, under date of April 11: "We are now operating similar roads for other companies at percentages varying from 60 to 70 per cent., for operation. I cannot now say definitely what the Western Union Company will charge for operating your line, but from what I know of the country through which your line is to run, and the traffic to be derived from it, would say 60 per cent. would be a fair charge for operation. There are many conditions that would vary the terms. From competing points on your line with roads leading to Chicago, the rates will be the same to Milwaukee as to Chicago. This connection with the Western Union line affords your people a connection with the East *via* the Detroit & Milwaukee Railroad, at competing rates with Chicago roads; affords access to the principal lumber districts of interior Wisconsin, viz: Oshkosh, Winneconne, Berlin and the districts tributary to the West Wisconsin Railway, also to all points in Iowa and Minnesota reached by the railways of the Milwaukee & St. Paul system. We will haul on favorable terms to your company all the local freight of your road to and from Milwaukee." Mr. C. W. Stewart, the Chief Engineer, organized one party last week, and probably will another soon, to complete the surveys, and the final location of the line will be made at once preparatory to construction.

Pan-Handle, Wheeling & Kentucky.

This company—until last winter known as the "Pan-Handle Extension"—is formed to build a road in West Virginia from the Kentucky line up the Ohio River. Brooke County, which joins the northernmost county in Virginia, has contracted to furnish the right of way and do the grading and masonry of 7 miles of road in the county. The company have made a like proposition to Ohio County to do ten miles of grading.

St. Louis & St. Charles.

This company has been organized to build a road from St. Louis to St. Charles and there connect with the St. Louis & Keokuk road. At a meeting of the officers of the company this week at St. Louis the engineers reported having surveyed three routes, all lying south of the North Missouri road. The line will cross the Missouri River on the St. Charles Bridge, now nearly completed.

Burlington & Missouri River in Nebraska.

The contract for bridging the first 30 miles of the road west from Lincoln has been let to Messrs. Baum & Long, of Lincoln. Mr. John Fitzgerald has contracted to grade the road from De Witt to Fort Kearney, to be completed by the first of November. Track-laying is to commence soon from Lincoln westward.

Missouri, Iowa & Nebraska.

The *Alexandria Commercial* says that the contract for laying the iron from Alexandria 17 miles northwest has been let to Mr. W. E. Dorwin, Assistant Superintendent of the Toledo, Peoria & Warsaw Railway.

Burlington & Southwestern.

The *Burlington Hawkeye* says: "The company expect to reach Farmington with the track by the first of May at the farthest. The bridge over the Des Moines River at that point has been contracted for, Walbaum & Co. taking the contract for the stone work, and Wells, French & Co., of Chicago, the superstructure. As soon as the bridge is finished track-laying will proceed westward from Farmington and continue until a junction is effected with the North Missouri road at Bloomfield, in Davis County. From Bloomfield the

track of the North Missouri road will be used as far as Moulton, and thence in a southwestwardly direction the road will be extended as fast as possible to some prominent point on the Missouri River. The tracklayers expect to reach Bloomfield in August.

"The principal car shops will probably be located at Burlington, but whether without any local aid from our citizens we have not been informed. The company are now preparing temporary shops in lower town near Whitaker's foundry."

Southern Pacific of California.

A telegram from San Francisco says that this company filed an amended certificate of incorporation, on the 15th inst., at Sacramento, with the object to purchase a contract to operate a continuous line of railroad from San Francisco through the counties of San Mateo, Santa Clara, Monterey, Fresno, Kerr, Tulare, San Bernardo, and San Diego to some point on the Colorado River—distant 720 miles as near as may be from the point of beginning. Also a branch road from Tehachape Pass, *via* Los Angeles, to the Texas Pacific Railroad, at or near the Colorado River, distant 324 miles; also, a line from Gilroy, in Santa Clara, passing through Santa Cruz and Monterey Counties, to Salinas City, or some point near it, 45 miles; also, such other branches as the directors may hereafter deem advantageous to be established. The directors of the corporation are Lloyd Tevis, Leland Stanford, Charles Crocker, C. P. Huntington, Mark Hopkins, Charles Mayne and Peter Donohue. Capital, \$75,000,000. This is substantially the Central Pacific Company, which seems in a fair way to control all lines that may be built west of the Rocky Mountains. The *San Francisco Alta California*, before this movement, speaks of the country on the line as follows:

Tehachape Pass is at the southern end of Tulare Valley, near the point where the Sierra Nevada unites with the coast mountains. It is distant 300 miles in a direct line from San Francisco, and at least 375 by any other route that would be selected by a railroad company. The Texas Pacific act assumes that the Southern Pacific Railroad Company of California, which intends to run a line from Gilroy to Fort Mojave, will pass through Tehachape Pass, but if they have selected that pass they have not published the fact.

From Tehachape to Los Angeles the distance in a straight line is seventy miles, and by the railroad route one hundred miles. Two mountain ridges are to be passed—the Main Coast ridge and the Santa Susanna ridge. The stage road crosses the former by the San Francisquito Pass and the latter by the San Fernando Pass. The country is, for the greater part of the way, dry, barren and hilly, and the traveler can ride for miles without seeing a house or a cultivated field.

From Los Angeles to the Colorado River, near Fort Yuma, the distance by a bee-line is 200 miles, and by railroad route 215 miles, most of the way across mountain and desert. The entire length of road from Tehachape to Fort Yuma, by way of Los Angeles, would be about 375 miles, and the amount of land granted is 12,800 acres per mile, or 4,800,000 acres in all. If the company, in consideration of the grant, will build the road, we shall consider the transaction very profitable for the government and people. The route is quite as good as that from Fort Yuma to San Diego, and if a breakwater were built so as to furnish secure anchorage at San Pedro, that place might aspire to become the main terminus of the Texas Pacific road.

The San Francisco papers announce that Mr. Strowbridge, who was Superintendent of Construction on the Central Pacific road, has commenced grading the Southern Pacific line at Gilroy, with 500 hands.

Ohio Railroads.

According to the forthcoming report of the Ohio Railroad Commissioner, the total length of main lines and branches in Ohio (without counting sidings) is 3,487 miles. Many of the lines extend beyond the State, and the proportion of earnings, expenses and profits have to be eliminated from reports that cover business of the companies in other States besides Ohio. These, however, are stated, in proportion to the miles in Ohio, as follows:

Proportion of earnings.....	\$27,909,308 39
Proportion of operating expenses.....	19,423,377 93
Proportion of net earnings.....	8,486,930 46
State taxes paid in Ohio.....	8,5,938 53

The Railroad Commissioner calls attention, in his report, to many violations of law by railway corporations. He says, in general terms, that "there is not a railroad operated in the State, either under special charter or the general law, upon which the law regulating rates is not in some way violated, nearly every time a regular passenger, freight, or mixed train passes over it. The speed of trains in towns and cities, and the occupation of streets and alleys by railroad tracks, are annoyances the law has in vain attempted to regulate. A chapter in regard to the watering of stocks asserts that the

stock of the Cleveland & Toledo Company's road has been watered until \$100 of the original now represents a par value in the market of \$260. One of the chapters is in relation to aid extended to railroads by counties, towns and municipal corporations. It is shown that the total amount of stock which has been subscribed and paid for by these is \$6,850,100. Of this amount, the total amount now held by the counties, towns and cities is \$3,151,750. Of this latter amount \$460,000 is paying dividends, and \$2,691,750 is of doubtful value. The remaining \$2,666,305 of the aggregate amount of stock subscribed and paid for has been sunk.

Lafayette, Muncie & Bloomington.

The grading of this road from Lafayette west to the State line is completed, and the piers for the canal and Wabash River bridges are finished. The favorable decision of the Supreme Court sustaining the county subscription voted, referred to in another column, will enable the company to proceed immediately with the grading on the Eastern Division, from Lafayette to Muncie, a distance of 80 miles. The grading and bridging of the Illinois portion of the line to Bloomington by the Lafayette, Bloomington & Mississippi Railroad Company have been completed some months, and it is expected that the work from that city to Quincy will soon be commenced.

A New Coal Route to Albany.

The Delaware & Hudson Canal Company are constructing a railroad from Nineveh to Lanesboro', in Susquehanna County, Penn., 23½ miles. It will cross the Susquehanna River near Harpersville by a bridge 450 feet long, in three spans of 150 feet each. A short distance above this point it will cross the Starucca Creek, directly under the Erie Railway, by a bridge 150 feet long, and 60 feet below the Erie Railway track. Two miles above the viaduct a junction will be made with the Jefferson Railroad, which runs from Carbondale, Penn., where the Delaware & Hudson Company own large mines. The object of this road, which is in reality a branch of the Albany & Susquehanna Railroad, is to shorten the route from the coal mines to the Albany market, which it does by 26 miles, and by a grade no heavier than 30 feet to the mile. A saving of 40 cents per ton in the transportation of coal from Carbondale to Nineveh, where the new route joins the main line of the Albany & Susquehanna Railroad, will also be effected. The contractor for the grading of the road is Gen. Diven, of Elmira. Six hundred men are now at work, and nearly all the grading has been accomplished. Steel rails weighing 62 pounds to the yard are to be laid. The road is expected to be completed by the first of October next, and will be used for the coal trade only.—*New York Tribune*.

Richmond & Atlanta Air Line.

Messrs. Gomer & Mills, of Greenville, N. C., have contracted to grade 8½ miles of this road from Greenville westward, to be finished this season. All the contracts for grading between Charlotte, N. C., the eastern terminus, and Greenville, have been let. When completed, the road is to connect Charlotte with Atlanta, Georgia. Some 60 miles of the road in Georgia is already in operation.

Atchison, Topeka & Santa Fe.

The Topeka Commonwealth is authority that the grading of the northern extension is progressing; on the western extension the telegraph poles are set beyond Osage City; the track is laid 7½ miles beyond Cottonwood Falls, in Chase County; fifty new stock cars have been added to the company's equipment, and fifty more are expected soon.

Boston & Maine.

The Maine Legislature, at its last session, authorized the company to extend its line from Berwick through the towns of South Berwick, North Berwick (if necessary), Wells, Kennebunk, Kennebunkport, Biddeford, Saco, Scarborough and Cape Elizabeth to some convenient point in the city of Portland, and the company have appointed Mr. Henry Bacon Chief Engineer, and he has already made a reconnaissance of the route. The Portland Argus learns that the road will be built at once, as soon as the location is definitely made.

Portland, Rutland, Oswego & Chicago.

The Portland Argus learns that Mr. George Wadsworth has completed the survey "from the State line to a point of connection with the line of Leonard's survey in Tamworth. From the State line to the line of the Great Falls & Conway road at West Ossipee (at Bank's Hotel) is eleven and one-quarter miles by a most favorable route. From West Ossipee to Meredith the distance is 22 miles to a point of connection with the Boston, Concord & Montreal Railroad, making the distance from Portland to Meredith 73 miles."

Iowa Midland.

The work of grading is going on in nearly every unfinished mile from Anamosa to the crossing of the Day-

port & St. Paul road, three miles south of Maquoketa. It will be remembered that the road was located to pass by Maquoketa when that city failed to vote the 5 per cent. aid tax.

Arkansas Railroads.

The Chief Engineer of the Cairo & Fulton Railroad sends information of the progress of that company as well as the Little Rock & Fort Smith Company:

"The Cairo & Fulton Railroad is in rapid progress. Twenty miles of road are completed ready for operation from Little Rock northward. The thirty miles beyond will be ready for the track by the 15th of May. Probably a connection with the St. Louis & Iron Mountain Railroad, at the Missouri line, will be made in 12 or 15 months, making direct communication in almost an air line, between Little Rock and St. Louis. The surveys and locations southward are complete for a distance of about 75 miles. Iron for 20 miles of track is in New Orleans, to be shipped at once. Three locomotives are on the way, and twenty flat cars have already arrived.

"The Little Rock & Fort Smith Railroad is completed and in operation for a distance of 50 miles (to Lewisburgh). Grading from that point to Van Buren is very nearly completed. The iron is on hand at Huntersville, the terminus of the road, opposite Little Rock, for between 30 and 40 miles, and iron for 20 miles more has been shipped from New Orleans."

Jefferson City & Southwest.

Gen. Harding, Chief Engineer, has made a preliminary survey from Jefferson City, Mo., southwest to Leavenworth, and is now engaged in locating the line.

Boston, Barre & Gardner.

The contract for building the passenger stations and freight houses on the line has been let to Messrs. Goodspeed & Falis, of Hubbardston. There will be, in all, eleven buildings—a passenger and freight house, and also car and engine houses, in Gardner at the terminus of the road; and station buildings in Holden, Princeton and Hubbardston, the passenger houses to be 22 by 42 feet. Work on them will be begun at once, and buildings of the most approved modern style will begin at once and buildings of the most approved modern style will be erected.

Holyoke & Belchertown.

The survey of this proposed Massachusetts road is now in progress. The route, according to the Boston Advertiser, passes through the village of South Hadley Falls, the center of South Hadley and a portion of Granby to Belchertown, there connecting with the New London Northern and, as yet visionary, Massachusetts Central.

New York & Harlem.

The stockholders have voted to increase the capital stock by the amount of \$2,000,000, "for the purpose of completing the new depot at Forty-second street, and the Madison avenue line from Forty-second to Eighty-sixth street, and the purchase of necessary equipments for operating the same."

Montreal to Duluth.

Montreal talks of a railroad from that city up the Ottawa River and north of Lake Nipissing and Georgian Bay to Sault Ste. Marie, there to join a railroad from Duluth eastward through the upper peninsula of Michigan. These would form an outlet for the Northern Pacific without the detour south of the lakes; and the line to Halifax, soon to be completed, would give it an outlet at the easternmost Atlantic harbor.

Montreal, by this route, would be only about 900 miles from Duluth, or as near as Chicago is to New York; and Halifax, by way of Montreal, would be about as far as New York is by way of Chicago. With the Northern Pacific completed, there would then be a railroad line about 3,100 miles long, extending from Halifax to Puget Sound, and connect with Europe and Asia by the shortest sea routes.

Mansfield, Coldwater & Lake Michigan.

At a meeting of the stockholders of this company in Mansfield on the 18th inst. the consolidation with the Ohio & Michigan Company was confirmed. Mr. W. Hickox, the President, said that full and satisfactory arrangements had been made with the Pennsylvania Railroad Company for iron, rolling stock and equipment of the whole line, and that good and *bona fide* subscriptions of stock had been secured on the line sufficient to grade, tie and bring the road-bed ready for iron; that two corps of engineers are now at work in Ohio, and that all the work will be put under contract as soon as the estimates and grades can be completed. The contractors in Michigan, F. S. Rose & Co., have nearly 4,000 men at work, and have their grading all done but about fifty-eight miles. They have notified the company that in twenty days they will have from 800 to 1,000 Swedes, who can be spared for the Mansfield end of the line. The officers are in strong hopes

of completing the road within the year. He congratulated the stockholders on the progress that had been made in their enterprise, the organization having had less than eight months' existence. He also informed them that arrangements had been agreed upon by which a line running from Tiffin to Tolono would be built in connection with their line, ample means having been secured to complete the same. The first election of directors of the new consolidated company will be held in Coldwater, Mich., May 10.

St. Paul & Sioux City.

Mr. Gere, Engineer of the company, has been making surveys between St. James and Sioux City, south of the old route, and reports that a good line has been found which will materially shorten the distance. It is expected during the present season to lay 50 miles of track southwest from St. James, the present terminus. Messrs. Allen & Bishop are the contractors.

Walkill Valley.

About 30 miles of this road from Goshen, Orange County, N. Y., to New Paltz, Ulster County, is completed. Between New Paltz and Rosendale, about 12 miles, the construction is progressing. The New York Bulletin has information that the "contract for the grading and masonry on the third division of this road, from Rosendale to Kingston, (about 10 miles) has been awarded to A. L. Dolby & Co., to be completed on the 15th of October next. A section of this road lately laid with track, from New Paltz to Guilford, over which trains have been running, has been declared unsafe for travel, and the managers have withdrawn all trains until the road is "ballasted" and put in proper condition. At Rosendale an iron bridge for the road is to be constructed, 900 feet long. The Legislature of New Jersey has passed an act authorizing the Walkill Valley Railroad Company to extend the road through that State to the point deemed most feasible to connect with any railroad that will give a through route to Washington. To aid in the extension of this road along the Hudson, the Legislature of this State has authorized the towns in the counties of Greene and Albany to issue bonds to the extent of one-twentieth of the taxable property, upon the written petition of the tax-payers."

Essex Branch.

Woods, Harris & Mead, the contractors, have commenced the construction of this railroad, which will extend from Wenham, 22 miles north of Boston on the Eastern Railroad, about five miles eastward to Essex.

Port Huron & Lake Michigan.

The 7 per cent. bonds of this company "having the endorsement of two railroads, the Great Western of Canada and the Detroit & Milwaukee," are advertised in New York for sale at 90.

Augusta & Hartwell.

The engineers on the South Carolina Railroad are endeavoring to modify and improve the line already run to Broad River. It is said that work on the road will be commenced very soon and pushed forward as fast as possible. A. Grant Childs is Chief Engineer.

Putnam & Dutchess.

The Putnam County Courier says Chief Engineer St. John, of the New York & Boston Railroad, is prospecting a route for another new road, which will be known as the Putnam & Dutchess Railroad. It is to commence at Carmel and run north through Ludington to Whaley Pond, where the new company propose using the Boston, Hartford & Erie road-bed to Hopewell, thus forming a continuous line from New York to Albany.

Oregon Railroads.

Concerning the Oregon roads, we have a number of reports and rumors. The Willamette Valley Railroad Company has filed a map of their route from Portland to Forest Grove and thence south to McMinnville, with a branch northwest toward Astoria. The Oregon Branch Pacific Railroad contemplates a route from a point on the Central Pacific Railroad at or near Winnemucca, Nevada, by way of Goose Lake, Sprague's River and Klamath, across the Cascade range of mountains in the vicinity of Diamond Peak, to the navigable waters of the Columbia River, in the vicinity of Portland, Oregon.

At a recent meeting at Portland, it was resolved that a road ought to be built from that city through the Columbia gap of the Cascade range, by way of Eastern Oregon and Southwestern Idaho, to some point of intersection with the Union Pacific Railroad, and that measures be taken to organize the Portland, Dalles & Salt Lake Railroad Company. On the western end, 700 men are employed and Klamath is exceedingly lively. We hear of shipments of materials for the road every now and then. Work at Puget Sound will be commenced soon. The Yellowstone route will be followed (*New Northwest*) but between the Yellowstone and the Columbia all is uncertain.—*Scientific Press*.

Papers on Iron and Steel.

BY W. MATTIEU WILLIAMS.

IV.—THE BESSEMER PROCESS (CONTINUED).

The magnificent shower of sparks which accompanies the turning over of the converter is easily explained. The blast has, of course, to be maintained during this turning over, until the whole of the melted material is clear of the openings through which the blast is forced. As these cover a considerable area at the bottom of the converter, the edge of the liquid passes them successively, and at the moment of thus passing the blast cuts the surface of the melted matter almost horizontally. But what is this melted matter? It is a pool of iron, on the top of which is floating a thick scum of silicate of iron, etc.—the "cinder." I use the term "silicate of iron" only in an approximate sense, as I doubt whether the silica is completely oxidized.

My reasons for doubting it are, that the particles which are driven out of the converter by the blast are, to some extent, explosive; they are seen to burst with brilliant coruscations, which are partly due to further oxidation; and when the granules which shower upon the floor are examined in the microscope, they present a very curious appearance. They are minute hollow spherules, miniature bomb-shells, varying considerably in diameter from one-tenth of an inch to one-fiftieth and less in diameter. The largest are more or less broken, commonly of a basin shape, shown in Figs. 1 and 2.*

The smaller spherules are for the most part perforated. My friend, Mr. Joseph Bragg, who has carefully examined these, and to whom I am indebted for the drawings from which the engravings are copied, says: "I can hardly satisfy myself that any are quite without apertures, though some have no distinct round holes as most have, but in these cases there are minute openings between and under the welded scales or plates which often cover the spherules, giving them a rough surface." Conglomerate groups of these spherules, such as are shown in Figs. 3* and 4, are very common, and some are attached to irregular lumps of cinder, as shown by the right-hand fragment of Fig. 3. A few are pear-shaped (see Fig. 4). On the right of these pear-shaped specimens are shown some of the smaller spherules in which the perforations are less evident. In the smallest, as the agglomerated and attached specimens (Fig. 3), the perforations are very obscure or doubtful.

Sir Samuel Baker, in his "Nile Tributaries of Abyssinia," describes some natural products to a similar action on a vastly larger scale, viz., the volcanic eruption of a flood of gaseous matter through fused silicates. He says, "Rows of broken hills, all of volcanic origin, broke the flat plain. Conical tumuli of volcanic slag here and there rose to the height of several hundred feet. We entered a dead level plain of orange-colored sand, surrounded by pyramidal hills; the surface was strewn with objects resembling cannon shot and grape of all sizes, from a 32-pounder downwards; the spot looked like the old battle-fields of some infernal region. . . . I dismounted to examine the Satanic bombs and cannon shot. Many of them were as perfectly round as though cast in mould, others were egg-shaped, and all were hollow. With some difficulty I broke them, and found them to contain a bright red sand; they were, in fact, volcanic bombs that had been formed by the ejection of molten lava to a great height from active volcanoes; these had become globular in falling, and having cooled before they reached the earth; they retained their forms as hard spherical bodies, precisely resembling cannon shot. The exterior was brown, and appeared rich in iron. The smaller specimens were the more perfect spheres, as they had cooled quickly, but many of the heavier masses had evidently reached the earth when only half solidified, and had collapsed in falling. The sandy plain was covered with such vestiges of volcanic action, and the infernal bombs lay as imperishable relics of a hailstorm such as may have destroyed Sodom and Gomorrah." To a Lilliputian traveler about an inch and a quarter high the floor of a Bessemer shop would present about the same aspect as this volcanic plain presented to Sir Samuel Baker, and would appear on about the same scale relative to the traveler's own dimensions.



Fig. 4.

It may have been remarked that in the above I have never used the word "slag," which in chemical works is usually applied to the separated silicate of iron, etc., however it may have been separated. I have called it "cinder," in accordance with the nomenclature of the workshop, for in the use of these terms, slag and cinder, the workshop is more learned than the University, even in the matter of etymologies, which occupies so absorbing an amount of University attention.

Whenever the silicate is separated by fusion, or the direct action of the fire, he calls it "cinder," when it is squeezed out from a bloom or pile by the blows of the hammer he calls it "slag." Now the Scandinavian name of fire refuse or dross is *sinner*, the German for the same is *sinter*. The Scandinavian for a blow is *slag*, the German *schlag*. I have observed with much interest the constancy with which the workmen adheres to the strictly etymological significance of these words, while learned writers utterly confound them. Of course the workmen are unacquainted with their origin, nor have

I ever seen their distinctive etymologies pointed out by anybody else. They afford an interesting illustration of the technical continuity of modern English with its ancient Scandinavian basis. Our metal workers, like our sailors, still speak the strong tongue of the old Norseman. There are scientific as well as etymological reasons for the distinction between cinder and slag, and therefore I adopt the workmen's phraseology.—*Nature*.

Railroad Records.

The destruction of buildings and their contents—relics of antiquity, or records of modern knowledge, or the accumulated materials out of which knowledge is to come through the studies of future men—by war, in Europe, impresses both the historian and the scholar painfully. It has occurred in all ages. It happens still; and often on a grand scale, as in the recent ruin of the libraries and museums of Strasburg.

The war of 1861-5 was characterized by one of the most extensive and completest devastations of this sort. Very few public buildings and private mansions in the Southern States escaped sacking. Scarcely a State paper, rare book, or railway survey, is now to be found in its proper place. Whole libraries, like that of Chief-Justice Marshall, were heaped upon the floor, the volumes cut through the back, the pictures torn out, and the fragments used to light camp fires. Entire State records were scattered or destroyed. The invaluable series of State Survey of Old Virginia has disappeared. All the early maps of the land office at Richmond are gone; and Richmond is but one of many other points of collection which became, suddenly, points of irretrievable dispersion of materials for history, and legal decision, unique in themselves, and of priceless value for future generations.

In no department has the loss of documentary evidence of past work done mounted to such a figure as in the department of railroad construction. Scarcely a single railway company of the South preserved a preliminary survey of its route, or even a profile of its actual grades. We have tried in vain to obtain authentic information even of the terminal elevations above tide. The approach of a Northern or of a Southern army corps was equally dreaded. Files of papers, map rolls, profiles, account books, were hurriedly tumbled into such bags and boxes as were at hand, and secreted in private houses, which were in their turn ransacked by the soldiers, and the deposits scattered or burned.

The same fate befell the manuscript survey maps and descriptions of mining and manufacturing companies; and seldom now can any private or official collections of this kind be found complete. Most of the company organizations went to sleep, or into bankruptcy, or into other hands, or were operated through the military orders of Confederate officers.

It is quite true that, in time of peace, the loss of records, sometimes of the rarest kind and highest value, is continually taking place from the officers of the best established corporations in the Northern States. As an instance, we may mention the disappearance of the elaborate topographical survey maps of Fayette, Cambria and Westmoreland, in Western Pennsylvania, on which several years of instrumental and geological work was bestowed, about fifteen years ago. No clue to their whereabouts can now be obtained. Whether they are lying in their tin case in some overlooked corner of the offices in Philadelphia, or whether they are carefully concealed in some private person's bureau drawer in the country, is a question which, even if it could be answered, might not bring them to light. But the retention of such maps by any private individual is so reprehensible that we must believe the loss to be accidental, and the restoration only a matter of time.

Thousands of such instances might be cited. Such losses occur in Europe as well as in America. Yet nothing strikes a traveler more forcibly than the care bestowed upon the treasures of museums, libraries and government bureaus abroad. In coming years no doubt the same carefulness will become habitual to officials in our country. But the small and regular salaries affixed to European functions, the economical and stationary habits of the people of the Old World, and the strict subordination and personal responsibility demanded of every employee of government under pain of the severest of all punishments—dismissal—operates as an effectual check upon disorder and peculation in the cabinets and libraries of museums and in the offices of railway and manufacturing companies.

On the other hand, the migratory habits of the Americans, the frequent change of employment, the facility with which young men climb into the most responsible positions, a certain national hatred of, and contempt for, what is nick-named by irresponsible people "red tape," the total absence of discipline, the impossibility of imposing any severe punishment for dereliction of duty, a country parted out under separate governments, yet allowing perfect freedom of translation from one place of business to another, and, as a consequence of all this, the lack of any well-established code of morals in the official and business world—to say nothing of the spiritual debauchment of the political world—renders insecure in any place of deposit any valuable record of the past history, any specimen of the present wealth of the nation, which may attract the fancy, or prove useful to the immediate pursuit of any individual citizen.

The opinion has been often expressed that Caliph Omar did the world a favor in heating the baths of Alexandria with the precious papyri of Psammetichus and the priceless parchments of the Ptolemies. We do not think that Lauth and Brugsch and Lepsius, Chabas, De Rouge and Birch, appreciate such opinions highly. Certainly, a vast amount of trash was happily got rid of at Strasburg; and a still larger amount would have relieved the world of its presence had the Prussians burnt Paris. But Newton is reported to have admired the quantity of dirt the Lord employs to make a planet, and the Bibliotheque-Nationale may be pardoned its roomfulls of scholastic tomes for the sake of the care it takes of single specimens of the most valuable works

of man. Not more than a thousandth part of the stuff so nicely laid away, sheet upon sheet, in the waters of the Coal Era is of the slightest mineralogical value; but without that thousandth part where would civilization have been now? A howling savage, a stupid peasant, or ragged beggar, and no more. Without the nine hundred and ninety-nine parts of trash the indispensable thousandth part could not have been preserved.

Fire-proof buildings for museums, libraries and railway offices are as needful as fire-proofs for banks. And the same watchful oversight and record should be kept over all surveys and profiles of railroads, as over church registers of marriages, births and deaths. No one ever knows when or how the most trivial scrap of honest and intelligent labor may become important to the office. If lost, the work must be done again, often in a hurry, always with a certain uncertainty because out of its true relations to other and cotemporary work. In this country time is money, and the shortness of hands should be compensated for by length of head, care, order and discipline.

As to Railway Records, all our companies, Northern as well as Southern, will, in course of time, no doubt order re-surveys of their lines to recover the contents of their lost documents. But in the mean time much may be done by those who feel a scientific interest in, or have business need of, the data which have disappeared. We will give an illustration.

The other day we had occasion to look at the Orange & Alexandria Railroad, wanting to get a good idea of its profile of grades. We took notes with a particularly excellent aneroid barometer made for us by Becker & Sons, of New York, some years ago, on a new plan; the circle being divided into 4,000 parts, 2,000 to a mercurial inch, or rather to 1,000 feet of elevation; so that variations of height amounting to only $2\frac{1}{2}$ feet can be easily read without a glass. The instrument has no back-lash in its joints worth noticing, and is quick in answering to a reversal of grade. We shall give our notes in another column, merely as a specimen of the way in which the essential features of any railway line can be sketched from the car windows of an express train. It is needless to say that the absolute elevations cannot be thus obtained; because, even in a run of only five hours, the diurnal variation of the mercury will have its effect, and unless the day be very quiet, other meteorological changes may be super-added. But even these sources of error can be stopped by having a friend observe a stationary barometer at the same time. And if the day be fair, the errors can be practically annulled by adjusting the terminal points of the barometric sets of observations, to the established sea levels of the termini of the road, and elevating or depressing all the levels noted, *pro rata*.

Merely as a useful amusement to young engineers, we recommend this kind of barometric note work when they travel. After a little practice, they will be able to add topographical notes of the district through which the road runs; and in the absence of a map of the road, they can make a rude one for themselves by observing the sun in connection with their watch.—*United States Railroad and Mining Register*.

Railroads as Common Highways.

Now that the railway interest has become one of the controlling interests of the country, and has, by the shrewd management of operators, been placed within the almost absolute control of a small number of men, there are not wanting projects for removing the real or imaginary objections of the present system. One of these, possessing considerable backing in influential quarters, is to place the railways directly in the hands of the government as telegraph lines have been placed in England. Another is to compel by law the companies to permit any one to run trains upon their tracks with the same freedom that barges are permitted to travel in canals. The former may in time come to be a party or political question, but will not necessarily affect or be affected by the management of the roads as far as concerns the mechanical or engineering aspects of the same. The last-mentioned scheme, however, should receive its quietus because of the impossibility of maintaining efficiency of construction or operation if any one, whether responsible or not, is to be permitted to run cars upon railway lines.

We have not been slow to stigmatize in the strongest terms the carelessness which, under the present system, has too often caused disaster to railway trains, or the neglect to adopt improvements which would add much both to the safety and comfort of the traveling public. But we are satisfied that the number of accidents would be multiplied many times if the running of trains were in the hands of separate parties instead of under the systematic direction of a central authority. Railway management has become a science, and one that cannot be applied at random. Under the present system, a company is held responsible, by public opinion at least, for everything pertaining to its road, from a drunken switchman to a cracked axle, a broken rail, or a collision. How would the responsibility be fixed, or whose duty would it be to guard against casualty if the road were used by a dozen parties, running cars made according to a dozen standards of excellence or requirement, and run at any speed, or at any time, according to the caprice of the owners? It will, of course, be said that this could be arranged by mutual consent of parties, but this consent would only be effective through some organization to carry it out, and there would simply be a railway company after all, and one more complex and unsatisfactory than the present ones. As to the adoption of improvements, the railway corporations, slow and sluggish as they are, afford a hundred fold more encouragement to inventors than could be obtained from parties owning only a portion of the rolling stock of a railway, and possessed of a proportionally reduced capital capable of being spared in the trial or use of new apparatus or methods of construction.—*American Artisan*.

* Figs 1, 2, and 3 will be found on page 27 of this volume.

The Lake Superior Trade.

The report to the State of Michigan of the business of the Sault Ste. Marie Canal for 1870, lately published, gives a very clear statement of the growth of business on Lake Superior. The following summary is given by the Detroit *Tribune*:

The business of the St. Mary's Falls Ship Canal, for the season just closed, began on the 29th day of April last—the first boat having locked through on that day, upward bound—and continued without interruption until the 1st day of December instant—the last boat having locked through on that day, also upward bound.

FINANCIAL.

The balance of cash in hand at the date of my last annual report—December 25, 1869—and the total amount received on account of tolls, and also the total amount received for the use of the canal steam pump during the past season was as follows:

Balance of cash in hand, Dec. 25, 1869.....	\$2,251 64
Received on account of tolls.....	41,866 43
Received for use of steam pump.....	1,765 00
Total.....	\$45,912 07

There has been deposited with the State Treasurer, and expended as follows:

Total amount deposited with State Treasurer.....	\$25,889 47
Received.....	17,891 51
Leaving a cash balance on hand at this date, Dec. 25, 1870.....	2,125 09

Total..... \$45,912 07

The following is a statement of the monthly receipts on account of tolls during the season just closed:

Received in April and May.....	\$6,704 49
Received in June.....	6,991 12
Received in July.....	7,281 75
Received in August.....	6,472 75
Received in September.....	5,795 61
Received in October.....	4,704 21
Received in November and December.....	3,853 47

Total received on account of tolls..... \$41,866 43

The following is a comparative statement of receipts on account of tolls, for this with those of last year:

Receipts in 1869.....	\$31,579 96
Receipts in 1870.....	41,866 43

Increase..... \$10,316 47

THE LAKE SUPERIOR COMMERCE.

The total amount of tonnage of vessels, both steam and sail, that have passed through the canal both ways, the past season, was 626,825.91 tons, as follows:

Steam.....	288,501 47
Sail.....	408,324 44

Total..... 626,825.91

As compared with the season of 1869, as follows:

Total tonnage in 1869.....	594,844 73
Total tonnage in 1870.....	626,825.91

Increase..... 17,941.19

The tonnage of steamers that have passed through the canal during the season just closed, as compared with 1869, is as follows:

Tonnage in 1869.....	264,224 01
Tonnage in 1870.....	288,501 47

Increase..... 24,277 46

The tonnage of sail vessels that have passed through the canal the past season, as compared with 1869, is as follows:

Tonnage in 1869.....	260,600 71
Tonnage in 1870.....	408,324 44

Increase..... 147,663 73

The whole number of steamers and sail vessels that have passed through the canal the past season, was as follows:

Steamers.....	431
Sail vessels.....	397

Total..... 1,828

The number of passages of small coasting vessels and open boats through the canal the past season was 18. Some of these had no enrollment. Those that were enrolled were so small that, in estimating the amount of tolls to be paid by them, their tonnage was not taken into account. They were charged each \$5, as directed by law in such cases, making the amount received from this source \$90. Of the amount received on account of tolls, viz.: \$41,866.43.

The steamers paid.....	\$17,310 08
The sail vessels paid.....	24,496 35
Small coasting vessels and open boats.....	90 00

Total..... \$41,866 43

Of the amount of tolls received, to-wit, \$41,866.43, the Cleveland & Detroit Lake Superior line paid.....

Chicago line paid.....	\$8,427 44
Buffalo line paid.....	3,702 33
Canadian line paid.....	3,068 05

Transient steamers paid.....

Small coasting vessels and open boats paid.....	552 88
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Sail vessels paid.....

90 00

Total..... 24,496 35

The number of passengers reported as having passed up during the past season, by the Cleveland, Detroit & Lake Superior boats, was.....

4,173

Down by the same.....

4,152

Total..... 8,326

The number of passengers reported as having passed up by the Chicago line was.....

1,376

Down by the same.....

1,017

Total..... 2,395

The number of passengers reported as having passed up by the Buffalo line was.....

1,700

Down by the same.....

1,520

Total..... 3,230

The number of passengers reported as having passed up by the Canadian line was.....

1,540

Down by the same.....

1,742

Total..... 3,222

Grand total.....

17,153

It will be seen that there has been an increase in the business of the canal the past season, as the receipts show, as compared with that of last year.

The increase of tonnage of steamers and sail vessels, as compared with last season, is 17,941.19. The shipments of iron ore, etc., were much larger than last year, as will be seen by reference to the table of exports, hereinafter given.

THE PASSENGER TRAFFIC.

The following table gives the number of passengers reported as having passed up and down during last season by the Lake Superior Line of Steamers, also the total by each line, and the grand total, as follows:

	Up.	Down.	Total.
By the Cleveland & Detroit line.....	4,173	4,153	8,326
By the Chicago & Lake Superior line.....	1,368	1,017	2,355
By the Buffalo & Lake Superior line.....	1,700	1,820	3,220
By the Collingwood & Lake Superior line.....	1,540	1,742	3,282
Grand total.....			17,153

THE LAKE SUPERIOR TRADE.

The freight sent into the Lake Superior region through the canal last season was as follows: Pork, 8,083 brls.; flour, 2,397 brls.; beef, 4,931 brls.; bacon, 71,698 lbs.; lard, 334,766 lbs.; butter, 503,975 lbs.; cheese, 293,311 lbs.; tallow, 210,990 lbs.; candles, 183,707 lbs.; soap, 15,979 boxes; apples, 18,632 brls.; sugar, 1,250,158 lbs.; tea, 2,612 chests; coffee, 2,126 bags; salt, 11,080 brls.; vinegar, 738 brls.; tobacco, 179,630 lbs.; nails, 25,094 kegs; dried fruit, 63,644 lbs.; vegetables, 32,734 bu.; lime, 6,414 brls.; merchandise, 16,986 tons; coal, 15,952 tons; lumber, 647 m.; shingles, 160 m.; window glass, 3,389 boxes; hay, 2,366 tons; cattle, 2,461 head; horses, 231 head; sheep, 1,912 head; hogs, 1,072 head; birds, 1,297 m.; furniture, 22,532 pieces; machinery, 949 tons; glycerine, 180,000 lbs.; engines, 20; boilers, 16; liquor, 5,475 brls.; malt, 822,010 lbs.; eggs, 2,090 brls.; railroad iron, 17,497 tons; coarse grain, 303,377 bu.; ground feed, 2,021 tons; iron bars, 3,990; powder, 636 kegs; wagons, 125; kerosene oil, 2,790 brls.; lime stone, 701 cords.

The freight shipment from Lake Superior last season was as follows: Copper, 11,301 tons; iron ore, 409,850 tons; pig iron, 22,072 tons; fish, 23,717 half brls.; lumber, 75 m.; shingles, 765 m.; pelts and furs, 1,604 bales; hides, 5,220; tallow, 31,860 lbs.; flour, 9,578 brls.; silver ore, 92 tons; wheat, 49,700 bu.; barley, 700 bu.; potatoes, 1,000 bu.; building stone, 760 cords.

GENERAL SUMMARY.

The following is a statement of the receipts for each year from the opening of the canal, June 18, 1865, to the close of the season, December 1, 1870:

	1865	1866	1867	1868	1869	1870
	\$4,074 66	7,575 78	9,406 74	16,848 90	10,041 84	24,777 82
						16,072 56
						21,607 17
						30,574 44
						34,287 31
						22,389 64
						23,069 54
						33,515 64
						24,077 14
						31,570 96
						41,896 43

\$355,444 97

The growth thus shown is likely to be accelerated greatly hereafter by the construction of the Northern Pacific and the shipping of Minnesota grain from the head of the lake.

Barometer Notes on the Orange & Alexandria Railroad.

The following is a specimen of the observations which may be made on any express train with a watch and good aneroid barometer, for a study of the character of the route selected:

Charlottesville Station, 118 miles from Washington, 2:20 p. m. Barometer standing at 30.750. Opposite the University, 705. (*Note*.—This shows a rise of 45 feet; and so of all subsequent numbers.) Deep rock cut, 690. Rock cut, 680. Deep rock cut, 695. Fill 720, then deep rock cut. On little stream, 745.

From this low point there commences a steady rise along the west side of the low mountain range, through a gap in which the river runs at Charlottesville. Deep rock cut, 725. Ditto, 710. Brook from east, 700. Deep cut, 688. Deep rock cut, 680. Along foot of mountain in deep cut, 620. Ditto, 610. Ditto, 580. (Here trap boulders and very red soil.) Fill of 20 feet over brook from east, 575. Culvert, 520. Very red soil in plain, 500. Deep clay cut, 480. Fine mountain views open towards the southwest, 478. Clay cuts, 475. Long level, 475.

Descending grade rapid, along west side of a grassy vale. Deep cut, 525. Red Hill Station, 126 miles from Washington, 2:47 p. m., 538. High fill over meadows, 550.

Descending grade through cuts, 515,500. Fill, 498. Long cut, 490.

Descending grade, fill 500. New Garden Station, 129 miles, 518. Cut, 510. Fill, 535. Clay cut, 540.

Descending grade, fill 528. Deep clay cut, 510. Long cut, 505, fill 510, fill 20 feet 515, long deep cut 508 to 498, long fill 20 feet 480, cut 10 feet 475, fill 10 feet 472, cut 10 feet 465, cut 8 feet 440, fill 8 feet 425, side cut 415, long rock cut 20 feet 405, cut 360, cut 25 feet 355. Covington Station, 135 miles, 3:07 p. m. (stopped 10 minutes) 345, rock cut 342. (*Note*.—Whole barometric rise from Charlottesville, 408 feet.)

Descending grade, cut 456, three fills 465, 505, 555, deep cut 565, fill over small river 570, deep short rock cut 582. Faber's Mill Station, 140 miles, 3:26 p. m., 586. Then following the little river down always on the hillsides to the west of it, to Rockfish Station, 142 miles, 675. Here cross large river on a bridge 40 odd feet high. (*Note*.—Descent from summit = 333 feet in about 7 miles.)

Descending grade, cut 30 feet deep 670, red clay cut 20 feet 655, bridge over large creek 20 feet high 635, cut and fill 625, cut, fill, cut, 620, fill 615, rock cut 600, fill 575, bridge 20 feet 550, fill 505, still following up stream, long low fill 500, head of brook cut 20 feet 465, long rock cut 455 to 440 at south end, plain 440. (Here

note hills about 600 feet high to the east, and a similar range to the west, with a rolling plain ahead.)

Descending grade, little stream 470, low cuts and long fills all 500. Lovington Station, 149 miles from W., 3:50 p. m., 505, long low rock cut 520, fill 510, cut 530, fill 10 feet 528, cuts 525, 535, stream crosses to left 542, cuts 535, 528, fill 520, long cut 500 to 495, rolling level 520, stream left 520, rock cut 15 feet 505, stream left 495, very long cut 10 feet 470. Arrington Station, 154 miles, 4:08 p. m., 465, pine plain 460, no hills in sight.

Descending rapidly, brook on left, cut 510, fill 500, cut 10 feet 565, stream right 565, cut 20 feet 565, stream left 570, fill 565, cut 15 feet 565, long cut 10 feet 560, fill 20 feet 565, cut 15 feet 565, to Tie River Station, 157 miles, 4:12 p. m., 595. (River bank opposite very steep and rocky hillside 100 to 150 feet high, railroad about 40 feet above the water at the bridge, rocks vertical. Stopped 10 minutes.)

Ascending grades, 15 feet cut 575, fill 590, long 20 feet cut 540, stream 530, cut 525, fill 510, 10 feet cuts 500, 490, short deep fill 480, long 15 feet cut 475, long 15 feet 470, fill 465, very long 20 feet cut through massive rocks to New Glasgow Station, 159 miles, 4:27 p. m., 420.

Descending, valley of brook rapidly, alternate cuts and fills from 465 to 500, 15 feet cut 520, long low fill 530, stream left 540, 10 feet cut 555, stream left 550, long 20 feet cut 560, 15 feet 565, brooks, 555, large creek flowing east and a 30 feet fill 555.

Ascending, cuts and fills from 10 to 20 feet 540 to 490, long 10 feet cut 485, cuts and fills from 10 to 20 feet deep, with brooks flowing east all 500. Amherst Station, 165 miles, 4:47 p. m., 500, cuts and fills 495, 495 (mill race) creek left 495, 15 feet cut 492, 12 feet cut 490, creek left 495, cut 488, fill 475, 12 feet long cut 465, fill 460, cuts 450, 440, stream right 430, 10 feet cut 425, fill 420, cut 415, stream right 415, cut 415, stream right 412, 20 feet cut 410 to 400, stream 390. (Fine mountains seen to the west), stream right 375, cut 360, long 15 feet cut 350, long cut 330, long cut 320, stream left 315, long cut 310, fill 305, long cut 300, stream left 300, long cut 295.

Descending, cuts and fills, 310 to 330, stream left 350, cut 355, fill 360, 25 feet cut 365, stream 375, stream left 395, 15 feet cut 410. McIver's Station, 171 miles, 4:57 p. m., 420, (water 20 feet below railroad and east of it), stream left 445.

Ascending